

Bacterial Source Tracking Analyses to Support Virginia's TMDLs

Non-Shellfish Stations

Prepared by

MapTech, Inc.

in cooperation with

New River Highlands RC&D

for

Virginia Department of Environmental Quality

Contract #13454

Submitted August, 2008

(Phase VIII)



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ACKNOWLEDGEMENTS

MapTech's Environmental Diagnostics Laboratory

Charles Martin, Virginia Department of Environmental Quality (VADEQ)

Roger Stuart, VADEQ

Regional VADEQ Offices

Robert Wittman, Virginia Department of Health (VDH)

Regional VDH Offices

Thank you to the many state agency representatives and stakeholders who assisted with sample collection.

MapTech, Inc. of Blacksburg, Virginia, conducted this study with funding provided by New River Highlands RC & D (Contract # 12186), made available through a grant from the Virginia Department of Environmental Quality.

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Bacterial Source Tracking Analyses to Support Virginia's TMDLs

1. INTRODUCTION

EPA's document, *Guidance for Water Quality-Based Decisions: The TMDL Process* (USEPA, 1999) states:

According to section 303(d) of the Clean Water Act and EPA water quality planning and management regulations, States are required to identify waters that do not meet or are not expected to meet water quality standards even after technology-based or other required controls are in place. The water bodies are considered water quality-limited and require TMDLs.

. . . A TMDL, or total maximum daily load, is a tool for implementing State water quality standards and is based on the relationship between pollution sources and in-stream water quality conditions. The TMDL establishes the allowable loadings or other quantifiable parameters for a water body and thereby provides the basis for States to establish water quality-based controls. These controls should provide the pollution reduction necessary for a water body to meet water quality standards.

The purpose of this project is to use bacterial source tracking (BST) to identify sources of *E. coli* to support the development of Fecal Bacteria TMDLs for impaired segments in Virginia. In fulfilling the state requirement for the development of a TMDL, a systematic process will be utilized to establish the maximum allowable bacteria loading for each waterbody to meet the applicable standard, allocate that load among pollutant contributors, and provide a basis for taking actions needed to restore water quality. This report focused on water quality sampling conducted in non-shellfish waters.

Bacterial Source Tracking (BST) methods can be subdivided into three basic groups: Molecular, Biochemical, and Chemical. Molecular (genotype) are typically referred to as "DNA fingerprinting" and are based on the unique genetic makeup of different strains, or subspecies, of fecal bacteria. Biochemical (phenotype) methods are based on an effect of an organism's genes that actively produce a biochemical substance. The type and

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quantity of these substances produced under various conditions is what is actually measured. Chemical methods are based on finding chemical compounds that are associated with human wastewaters, and generally are restricted to determining if sources of pollution are human or not.

Two techniques were used to determine sources of fecal bacteria for this study. Hagedorn's (Hagedorn et al., 1999) Antibiotic Resistance Analysis (ARA) technique was used because it has been demonstrated to be a reliable procedure for confirming the presence of human, livestock, wildlife and pet sources. Compared to DNA fingerprinting, biochemical profiling is much quicker, typically allows for many more isolates to be analyzed (*e.g.*, hundreds per week vs. a few dozen per week for DNA analysis), is more economical, has survived limited court testing, and has undergone rigorous peer review from the scientific community. Additionally, observation of an increased number of isolates allows for an estimate of the relative proportions of the fecal indicator (*e.g.*, *E. coli*) originating from different sources. Fluorometric analysis was also used to determine the concentration of optical brighteners. Optical brighteners are used in laundry and dishwasher detergent, as well as toilet paper. Their presence in high levels indicates the likely presence of human wastewater.

2. OBJECTIVES

As described in Chapter 1, two types of BST were used in this study; a fluorometric technique was used to detect human sewage, and ARA was used to identify sources of *E. coli* as well as the relative percentage contribution from source groups (*i.e.*, livestock, wildlife, human and pets) to support the development of Fecal Bacteria TMDLs for impairments located throughout Virginia. BST results will be used to improve public awareness of the problem, improve model calibration/validation of bacteria densities, and provide a more equitable allocation of loads to source classes.

The specific objectives of the project were to:

1. collect fecal samples from known sources in ten areas, based on Hydrologic Unit Codes (HUCs),
2. use collected samples to develop a known-source library for each impairment area, and
3. perform bacterial enumerations and BST analyses on whole water samples from impaired segments, using the libraries developed for objective 2.

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3. METHODS

Hagedorn's ARA method has been extensively and successfully used by MapTech, and separates fecal sources based on patterns of antibiotic resistance in the *enterococci* or *E. coli*. For this study, *E. coli* was the indicator organism analyzed. The premise of ARA is that fecal bacteria from each source (*e.g.*, human, livestock, wildlife, and pets) will have different resistance patterns to the battery of antibiotics and concentrations used in the analysis. Hagedorn's method for *E. coli* tests each isolate on 28 different combinations of antibiotic type and concentration. Confidence in BST techniques is measured by the level of separation of isolates from known sources, represented as the percentage of isolates that are accurately separated into respective source types (*e.g.*, Average Rate of Correct Classification – ARCC). Additional analyses can be applied to test the specificity of the library. These analyses are discussed further in Section 4 of this document. The ARA method, like other methods (*e.g.*, molecular), requires the collection of source samples from feces of known sources to build a source library. In support of this study, known source samples from the four source classes were collected, analyzed, and entered into known-source libraries. Additionally, a fluorescence spectrophotometer was used to quantify the concentration of optical brighteners in each water sample.

3.1 Collection of Known Sources

Known source samples were collected in four HUCs associated with fecal-bacteria impaired waters throughout Virginia (Figure 3.1). In HUCs where known-source samples had not previously been collected to support VADEQ's BST program (newly sampled HUCs), a total of 60 samples were collected. In HUCs where known-source sampling was completed within the past two years 20 known-source samples were collected. In HUCs where known-source sampling was completed more than two years previous 40 known-source samples were collected. Each set of source samples was distributed evenly between human, livestock, wildlife, and pets (Table 3.1). Specific species within each source category (*e.g.*, deer, raccoon, poultry, beef, etc.) that were selected to represent the sources in each region were identified through field observation, discussion with local stakeholders, and review of available data (*e.g.*, Virginia

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Agricultural Statistics). From each sample, up to 8 isolates were analyzed using BST to create a known-source library of 480 isolates for each newly sampled HUC, and to increase known-source libraries by 160-240 isolates in updated HUCs. To date, approximately 5,014 fecal samples have been collected to support VADEQ's BST program, resulting in over 39,760 isolates analyzed. In total 976 fecal samples were collected for this study, resulting in 7,540 isolates analyzed.

Table 3.1 Source samples collected for BST library development.

Source	Source Species	Number of Samples Collected in Newly Sampled HUCs	Additional Samples Collected in Updated HUCs (none within past 2 years)	Additional Samples Collected in Updated HUCs (within past 2 years)
Human	Septic Systems, Portable Toilets, ...	15	10	5
Livestock	Dairy, Beef, Horse, Sheep, Broilers, Turkeys, Swine, Waste Storage Pits, ...	15	10	5
Wildlife	Deer, Raccoon, Muskrat, Duck, Goose, ...	15	10	5
Pets	Dogs & Cats	15	10	5
Total		60	40	20

3.2 Development of Known-Source Libraries

An appropriate known-source library was selected for each of the impairments to complete objective 2. A predictive model was developed from each library using logistic regression. A known-source library must be large enough to prevent an over-specified fit to the library. However, known-source responses to ARA analyses have been observed to vary geographically. The characteristics of this variance have not been well defined, so the regional libraries developed for this study were combined in a stepwise procedure and analyzed to measure the resulting specificity and the predictive accuracy of the combined libraries, as detailed in Section 4 of this document.

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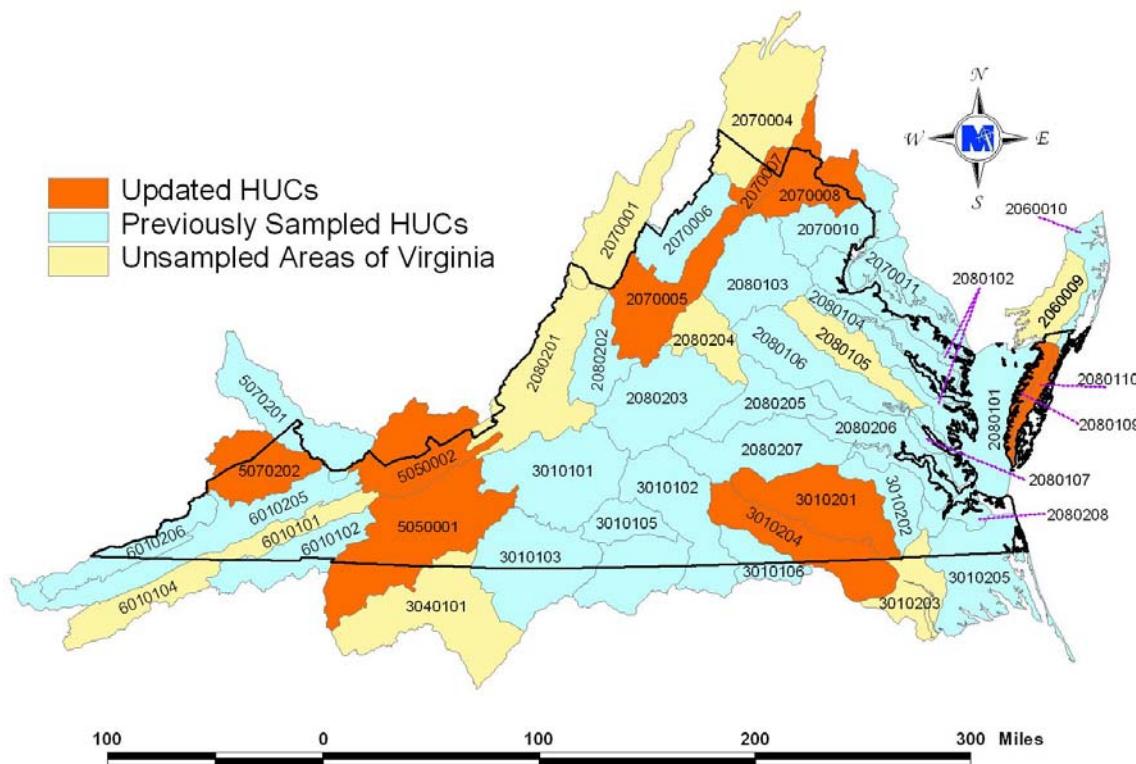


Figure 3.1 Locations of known-source sampling conducted to support this year's and previous years' BST analyses.

3.3 Bacterial Enumerations and BST Analyses

For objective 3, water quality monitoring sites were identified and sampled by the granting agency (Figure 3.2 and Table 3.2). For many sites, the contract began in January 2007. At the conclusion of the study, all sites will have been sampled as often as monthly for one year. Samples were received as whole-water samples (*i.e.*, ambient sampling as presented in Table 3.2). All water samples were analyzed for *E. coli*. BST was run on bacteria isolated from the whole-water samples. Bacteria were analyzed using Hagedorn's ARA methodology, yielding the percentage of isolates classified as human, livestock, wildlife, and pets. Up to 24 bacterial isolates were analyzed per sample, limited only by the number of isolates available from the enumeration process.

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Additionally, water samples were analyzed using a fluorescence spectrophotometer to determine the concentration of optical brighteners.

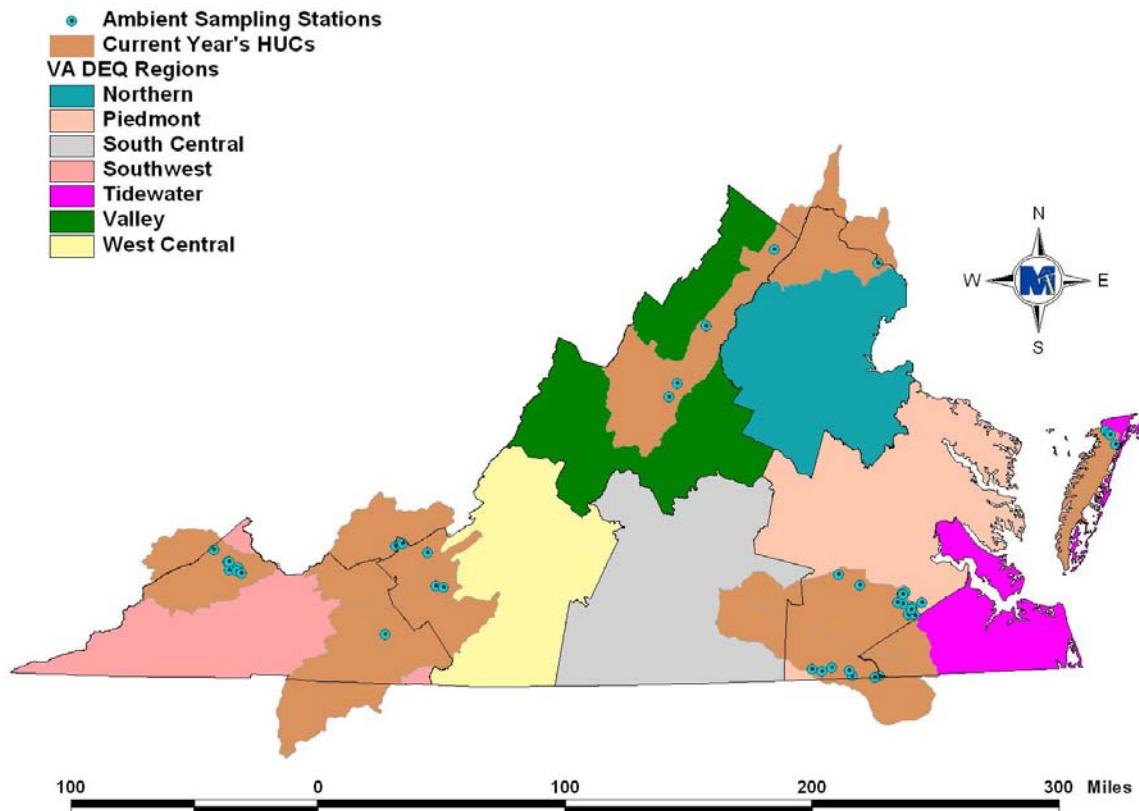


Figure 3.2 Spatial distribution of impaired segments identified by region.

**Bacterial Source Tracking Analyses
to Support Virginia's TMDLs**

Table 3.2 Distribution of ambient sampling stations addressed in this study.

Waterbody	Hydrologic Unit	Station ID
South River	02070005	1BSTH007.80
South Fork Shenandoah	02070005	1BSSF054.20
South Fork Shenandoah	02070005	1BSSF100.10
Spout Run	02070007	1BSPR000.40
Difficult Run	02070008	1ADIF000.86
Holens Creek	02080109	7-HLD002.67
Sandy Bottom Branch	02080109	7-SBB000.17
Unnamed trib. To Sandy Bottom Branch	02080109	7-XAZ00.30
Petit Branch	02080110	7-PET000.80
Hatcher Run	03010201	5AHRA016.25
Rowanty Creek	03010201	5AROW013.14
Assamoosick Sw	03010201	5AASM013.36
Assamoosick Sw	03010201	5AASM018.62
Assoosick Sw	03010201	5AASM021.22
Black Swamp	03010201	5ABLS001.58
German Swamp	03010201	5AGMN000.54
Nebletts Mill IRun	03010201	5ANBT001.26
Pigeon Swamp	03010201	5APNS001.15
Seacorrie Swamp	03010201	5ASRE005.89
Unnamed trib to Nebletts Mill Run	03010201	5AXDV000.46
Rattlesnake Creek	03010204	5ARSK003.08
Rattlesnake Creek	03010204	5ARSK009.28
Fontaine Creek	03010204	5AFON014.38
Fontaine Creek	03010204	5AFON022.04
Fontaine Creek	03010204	5AFON037.89
Unnamed trib. To Seacorrie Swamp	03010201	5AXDX001.15
Fontaine Creek	03010204	5AFON001.46
Cripple Creek	05050001	9-CPL001.03
Big Prater Creek	05070202	6ABIP000.18
Dismal Creek	05070202	6ADIS001.24
Levisa	05070202	6ALEV131.52
Levisa	05070202	6ALEV143.80
Levisa	05070202	6ALEV152.46
Levisa	05070202	6ALEV156.82
Slate Creek	05070202	6ASAT000.24
Connelly's Run	05050001	9-CNLL000.01
Plum Creek	05050001	9-PLM000.60
Adair Run	05050002	9-ADR000.13
Little Stony Creek	05050002	9-LRY000.28
Rich Creek	05050002	9-RHC000.08

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4. KNOWN-SOURCE LIBRARY DEVELOPMENT

As discussed in Section 3, a predictive model was developed from each library (HUC) using logistic regression. Where a previously developed library existed (*i.e.*, updated HUCs), this year's data was combined with the existing data and the updated library was used for further assessment. These regional libraries were combined in a stepwise procedure and analyzed to measure the resulting specificity and the predictive accuracy of the combined libraries. The specificity and predictive accuracy were assessed through three analyses. First, the ARCC was calculated for the library. Second, a randomization test was performed by randomly assigning source categories to samples and assessing the ARCC for the randomized library. Twenty-five randomizations were performed and the results averaged. The expected result of randomization of four source categories is an ARCC of 25%, indicating a completely random result. Greater values for the randomized ARCC indicate a more specified model. Third, a jackknifing routine was conducted, where data from each whole fecal sample were individually withheld during development of the statistical model. The model was then tested for predictive accuracy on the withheld sample. In combining regional libraries, a balance was sought between minimizing the randomized ARCC and maximizing the jackknifed ARCC. Table 4.1 shows the resulting analyses on the finalized libraries, and how the libraries were applied to the analysis of whole-water samples by the HUC in which they were sampled.

Table 4.1 Results of known-source library development.

Known- Source Library	ARCC (%)	Randomized ARCC (%)	Jackknifed ARCC (%)
02070005	71.7%	47.9%	48.2%
02070007	67.6%	46.4%	50.2%
02070008	70.2%	43.6%	55.5%
02080109	71.0%	47.2%	51.4%
02080110	68.8%	48.0%	51.2%
03010201	72.6%	44.5%	52.4%
03010204	87.3%	48.5%	NA
05050001	63.5%	35.5%	58.7%
05070202	64.1%	50.7%	43.6%
05050002	72.0%	41.8%	58.2%

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5. RESULTS

The results of the water quality analyses for VADEQ's 2007-2008 BST sampling in non-shellfish waters are reported in this section. *E. coli* enumerations, optical brightener concentrations, and the results of the BST analyses are reported. Optical brighteners concentrations (fluorometry results) are reported with the bacteria enumerations. As a rule of thumb, less than 50 ppb signifies little or no indication of human wastewater contamination. Between 50 ppb and 100 ppb signifies a potential for human wastewater contamination, which should be investigated if there is corroborating evidence (*e.g.*, high human proportions, aging infrastructure, or anecdotal evidence of illicit discharges). Over 100 ppb signifies likely contamination from human waste streams.

The bacteria source proportions reported are formatted to indicate statistical significance (*i.e.*, **BOLD** numbers indicate a statistically significant result). The statistical significance was determined through two tests. The first was based on the sample size. A z-test was used to determine if the proportion was significantly different from zero (alpha = 0.10). During the second test, the rate of false positives was calculated for each source category in each library, and a proportion was not considered significantly different from zero unless it was greater than the false-positive rate plus three standard deviations. The *E. coli* enumerations are reported with the BST results to give an indication of the bacteria concentration at the time of sampling.

5.1 Results for Valley Region

The results of the water quality analyses for VADEQ's Valley Region (Figure 5.1) are reported in the following tables. Table 5.1 indicates the number of samples analyzed in the 2007-2008 sampling phase. Bacteria enumerations, optical brighteners concentrations and BST analysis results are reported in Table 5.2 through 5.9.

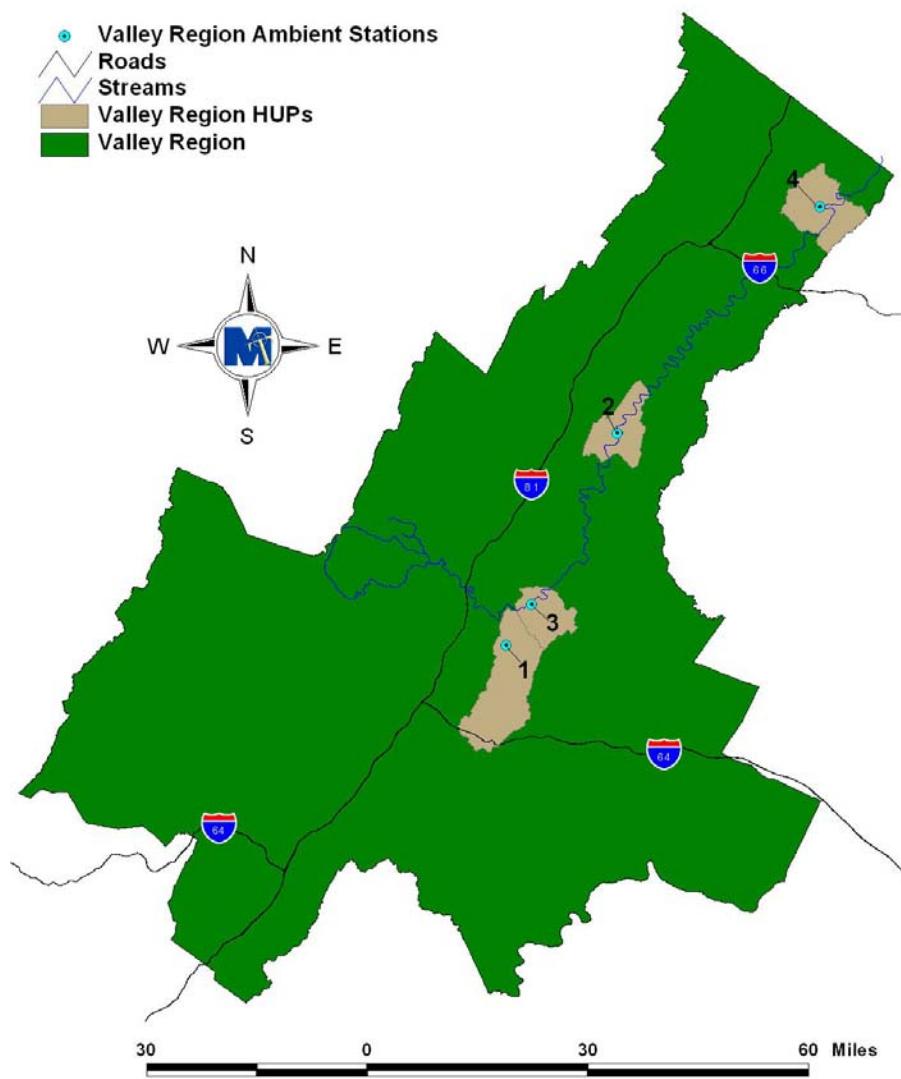


Figure 5.1 Bacterial sampling stations in Valley Region.

Table 5.1 Summary of bacterial sampling in VADEQ's Valley Region.

Station Number	Station ID	HUC	Stream Name	# of Samples Received	% Violations for <i>E. Coli</i>
1	1Bsth007.80	02070005	South River	12	8%
2	1Bssf054.20	02070005	South Fork Shenandoah	12	25%
3	1Bssf100.10	02070005	South Fork Shenandoah	12	8%
4	1Bspr000.40	02070007	Spout Run	12	25%

Table 5.2 Bacterial Enumeration for South River at Station 1Bsth007.80.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
1Bsth007.80	7/16/2007	D6919	7/17/2007	174	A	38.4		7/19/2007	MAF
1Bsth007.80	8/14/2007	D6955	8/15/2007	106		45		8/17/2007	MAF
1Bsth007.80	9/18/2007	D6994	9/19/2007	62		42.7		9/21/2007	MAF
1Bsth007.80	10/24/2007	D7034	10/25/2007	110		45.9		10/29/2007	MAF
1Bsth007.80	11/13/2007	D7043	11/14/2007	26	B	48.6		11/15/2007	MAF
1Bsth007.80	12/10/2007	D7079	12/11/2007	14	B	63.2		12/14/2007	MAF
1Bsth007.80	1/14/2008	D7135	1/15/2008	68		37.4		1/18/2008	MAF
1Bsth007.80	2/11/2008	D7167	2/12/2008	4	B	41.4		2/15/2008	MAF
1Bsth007.80	3/17/2008	D7213	3/18/2008	4	B	30.4		3/21/2008	MAF
1Bsth007.80	4/14/2008	D7247	4/15/2008	70		35.8		4/22/2008	MAF
1Bsth007.80	5/13/2008	D7277	5/14/2008	210		35.4		5/20/2008	MAF
1Bsth007.80	6/9/2008	D7314	6/11/2008	310		43.6		6/13/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.3 Bacterial Source Tracking for South River at Station 1Bsth007.80.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
1Bsth007.80	08/14/07	D6955	02070005	18	106	72%	0%	28%	0%
1Bsth007.80	09/18/07	D6994	02070005	11	62	45%	45%	10%	0%
1Bsth007.80	10/24/07	D7034	02070005	24	110	79%	0%	21%	0%
1Bsth007.80	11/13/07	D7043	02070005	9	26	22%	0%	78%	0%
1Bsth007.80	12/10/07	D7079	02070005	4	14	50%	0%	50%	0%
1Bsth007.80	01/14/08	D7135	02070005	16	68	0%	0%	100%	0%
1Bsth007.80	02/11/08	D7167	02070005	2	4	50%	0%	50%	0%
1Bsth007.80	03/17/08	D7213	02070005	1	4	0%	0%	100%	0%
1Bsth007.80	04/14/08	D7247	02070005	24	70	54%	4%	38%	4%
1Bsth007.80	05/13/08	D7277	02070005	24	210	29%	12%	59%	0%
1Bsth007.80	06/09/08	D7314	02070005	24	310	63%	12%	25%	0%
1Bsth007.80	08/14/07	D6955	02070005	18	106	72%	0%	28%	0%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.4 Bacterial Enumeration for South Fork Shenandoah at Station 1BSSF054.20.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
1BSSF054.20	7/16/2007	D6921	7/17/2007	22	B	47.3		7/19/2007	MAF
1BSSF054.20	8/14/2007	D6957	8/15/2007	201	A	48.6		8/17/2007	MAF
1BSSF054.20	9/18/2007	D6996	9/19/2007	34	B	48.8		9/21/2007	MAF
1BSSF054.20	10/24/2007	D7036	10/25/2007	650		75		10/29/2007	MAF
1BSSF054.20	11/13/2007	D7045	11/14/2007	30	B	51.9		11/15/2007	MAF
1BSSF054.20	12/10/2007	D7081	12/11/2007	18	B	47.7		12/14/2007	MAF
1BSSF054.20	1/14/2008	D7137	1/15/2008	2	B	32.8		1/18/2008	MAF
1BSSF054.20	2/11/2008	D7169	2/12/2008	10	B	37		2/15/2008	MAF
1BSSF054.20	3/17/2008	D7215	3/18/2008	6	B	31.7		3/21/2008	MAF
1BSSF054.20	4/14/2008	D7249	4/15/2008	28	B	39.7		4/22/2008	MAF
1BSSF054.20	5/13/2008	D7279	5/14/2008	>2000	L	69.8		5/20/2008	MAF
1BSSF054.20	6/9/2008	D7316	6/11/2008	330		64.8		6/13/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range.

L: Off-scale high. Actual value not known, but known to be greater than value shown.

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.5 Bacterial Source Tracking for South Fork Shenandoah at Station 1BSSF054.20.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
1BSSF054.20	07/16/07	D6921	02070005	11	22	73%	18%	9%	0%
1BSSF054.20	08/14/07	D6957	02070005	4	201	0%	0%	100%	0%
1BSSF054.20	09/18/07	D6996	02070005	2	34	0%	0%	100%	0%
1BSSF054.20	10/24/07	D7036	02070005	22	650	77%	0%	23%	0%
1BSSF054.20	11/13/07	D7045	02070005	16	30	38%	24%	38%	0%
1BSSF054.20	12/10/07	D7081	02070005	NVI	NVI	NVI	NVI	NVI	NVI
1BSSF054.20	01/14/08	D7137	02070005	2	2	100%	0%	0%	0%
1BSSF054.20	02/11/08	D7169	02070005	2	10	0%	50%	50%	0%
1BSSF054.20	03/17/08	D7215	02070005	2	6	0%	50%	50%	0%
1BSSF054.20	04/14/08	D7249	02070005	17	28	53%	6%	41%	0%
1BSSF054.20	05/13/08	D7279	02070005	24	>2000	38%	4%	58%	0%
1BSSF054.20	06/09/08	D7316	02070005	24	330	29%	12%	59%	0%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

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Valley Region

Table 5.6 Bacterial Enumeration for South Fork Shenandoah at Station 1BSSF100.10.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
1BSSF100.10	7/16/2007	D6920	7/17/2007	76		43.7		7/19/2007	MAF
1BSSF100.10	8/14/2007	D6956	8/15/2007	34	B	55.8		8/17/2007	MAF
1BSSF100.10	9/18/2007	D6995	9/19/2007	32	B	84.6		9/21/2007	MAF
1BSSF100.10	10/24/2007	D7035	10/25/2007	80		55.8		10/29/2007	MAF
1BSSF100.10	11/13/2007	D7044	11/14/2007	44		39.8		11/15/2007	MAF
1BSSF100.10	12/10/2007	D7080	12/11/2007	10	B	37.3		12/14/2007	MAF
1BSSF100.10	1/14/2008	D7136	1/15/2008	24	B	34.5		1/18/2008	MAF
1BSSF100.10	2/11/2008	D7168	2/12/2008	2	B	56.2		2/15/2008	MAF
1BSSF100.10	3/17/2008	D7214	3/18/2008	14	B	37.4		3/21/2008	MAF
1BSSF100.10	4/14/2008	D7248	4/15/2008	26	B	46		4/22/2008	MAF
1BSSF100.10	5/13/2008	D7278	5/14/2008	920	B	45.3		5/20/2008	MAF
1BSSF100.10	6/9/2008	D7315	6/11/2008	88		43.9		6/13/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.7 Bacterial Source Tracking South Fork Shenandoah at Station 1BSSF100.10.

VAEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
1BSSF100.10	07/16/07	D6920	02070005	23	76	88%	4%	4%	4%
1BSSF100.10	08/14/07	D6956	02070005	5	34	40%	20%	20%	20%
1BSSF100.10	09/18/07	D6995	02070005	9	32	22%	11%	22%	45%
1BSSF100.10	10/24/07	D7035	02070005	21	80	67%	0%	33%	0%
1BSSF100.10	11/13/07	D7044	02070005	19	44	37%	11%	41%	11%
1BSSF100.10	12/11/07	D7080	02070005	NVI	10	NVI	NVI	NVI	NVI
1BSSF100.10	01/14/08	D7136	02070005	6	24	33%	17%	50%	0%
1BSSF100.10	02/11/08	D7168	02070005	NVI	2	NVI	NVI	NVI	NVI
1BSSF100.10	03/17/08	D7214	02070005	1	14	0%	0%	0%	100%
1BSSF100.10	04/14/08	D7248	02070005	11	26	55%	18%	27%	0%
1BSSF100.10	05/13/08	D7278	02070005	24	920	21%	12%	63%	4%
1BSSF100.10	06/09/08	D7315	02070005	24	88	33%	21%	42%	4%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.8 Bacterial Enumeration for Spout Run at Station 1BSPR000.40.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
1BSPR000.40	7/16/2007	D6922	7/17/2007	256	A	37.4		7/19/2007	MAF
1BSPR000.40	8/14/2007	D6958	8/15/2007	230		52.7		8/17/2007	MAF
1BSPR000.40	9/18/2007	D6997	9/19/2007	130		27.7		9/21/2007	MAF
1BSPR000.40	10/24/2007	D7037	10/25/2007	356	A	39.9		10/29/2007	MAF
1BSPR000.40	11/13/2007	D7046	11/14/2007	90		60.9		11/15/2007	MAF
1BSPR000.40	12/10/2007	D7082	12/11/2007	88		61.1		12/14/2007	MAF
1BSPR000.40	1/14/2008	D7138	1/15/2008	38	B	24.6		1/18/2008	MAF
1BSPR000.40	2/11/2008	D7170	2/12/2008	10	B	26.5		2/15/2008	MAF
1BSPR000.40	3/17/2008	D7216	3/18/2008	24	B	50.4		3/21/2008	MAF
1BSPR000.40	4/14/2008	D7250	4/15/2008	40		27.2		4/22/2008	MAF
1BSPR000.40	5/13/2008	D7280	5/14/2008	>2000	L	90.5		5/20/2008	MAF
1BSPR000.40	6/9/2008	D7317	6/11/2008	140	B	33.3		6/13/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range.

L: Off-scale high. Actual value not known, but known to be greater than value shown.

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.9 Bacterial Source Tracking for Spout Run at Station 1BSPR000.40.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
1BSPR000.40	07/16/07	D6922	02070007	24	256	29%	0%	67%	4%
1BSPR000.40	08/14/07	D6958	02070007	11	230	46%	0%	27%	27%
1BSPR000.40	09/18/07	D6997	02070007	1	130	0%	0%	100%	0%
1BSPR000.40	10/24/07	D7037	02070007	24	356	58%	0%	38%	4%
1BSPR000.40	11/13/07	D7046	02070007	23	90	13%	48%	13%	26%
1BSPR000.40	12/10/07	D7082	02070007	24	88	8%	12%	72%	8%
1BSPR000.40	01/14/08	D7138	02070007	9	38	11%	22%	22%	45%
1BSPR000.40	02/11/08	D7170	02070007	2	10	0%	50%	50%	0%
1BSPR000.40	03/17/08	D7216	02070007	4	24	0%	25%	75%	0%
1BSPR000.40	04/14/08	D7250	02070007	19	40	5%	42%	32%	21%
1BSPR000.40	05/13/08	D7280	02070007	24	>2,000	33%	26%	8%	33%
1BSPR000.40	06/09/08	D7317	02070007	24	140	4%	21%	29%	46%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

5.2 Results for Northern Region

The results of the water quality analyses for VADEQ's Northern Region (Figure 5.2) are reported in the following tables. Table 5.10 indicates the number of samples analyzed in the 2007-2008 sampling phase. Bacteria enumerations, optical brighteners concentrations and BST analysis results are reported in Table 5.11 through 5.12.

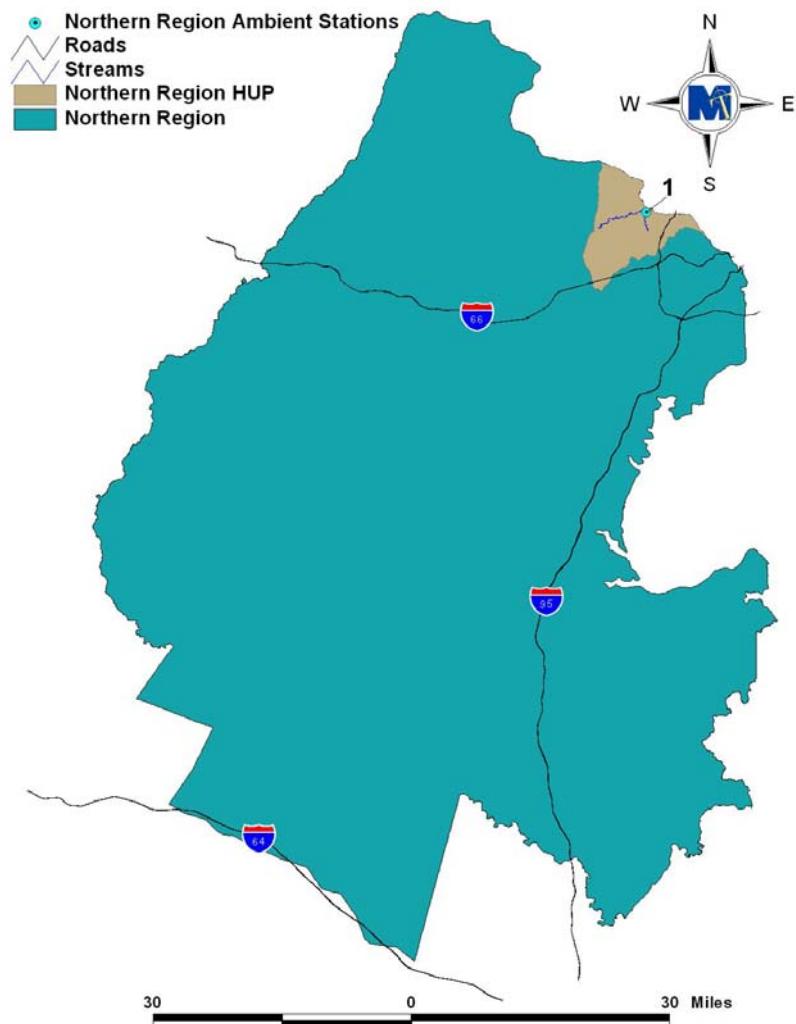


Figure 5.2 Bacterial sampling stations in Northern Region.

Table 5.10 Summary of bacterial sampling in VADEQ's Northern Region.

Station Number	Station ID	HUC	Stream Name	# of Samples Received	% Violations for <i>E. Coli</i>
1	1ADIF000.86	02070008	Difficult Run	12	0%

Table 5.11 Bacterial Enumeration for Difficult Run at Station 1ADIF000.86.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
1ADIF000.86	3/20/2007	D6784	3/21/2007	48		43.7		3/23/2007	MAF
1ADIF000.86	4/24/2007	D6825	4/25/2007	50		40.3		4/27/2007	MAF
1ADIF000.86	5/22/2007	D6844	5/23/2007	82		43.1		5/29/2007	MAF
1ADIF000.86	6/19/2007	D6907	6/20/2007	170	A	56.1		6/21/2007	MAF
1ADIF000.86	7/16/2007	D6923	7/17/2007	58		54.8		7/19/2007	MAF
1ADIF000.86	8/28/2007	D6976	8/29/2007	140		75.7		8/31/2007	MAF
1ADIF000.86	9/17/2007	D6991	9/18/2007	185	A	63.9		9/21/2007	MAF
1ADIF000.86	10/30/2007	D7042	10/31/2007	104		82.4		11/2/2007	MAF
1ADIF000.86	11/27/2007	D7055	11/28/2007	94		55.8		11/30/2007	MAF
1ADIF000.86	12/20/2007	D7122	12/21/2007	104		53.6		12/28/2007	MAF
1ADIF000.86	1/30/2008	D7161	1/31/2008	30	B	34.7		2/5/2008	MAF
1ADIF000.86	2/26/2008	D7196	2/27/2008	18	B	38.1		3/3/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.12 Bacterial Source Tracking for Difficult Run at Station 1ADIF000.86.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
1ADIF000.86	03/20/07	D6784	02070008	24	48	0%	42%	0%	58%
1ADIF000.86	04/24/07	D6825	02070008	24	50	0%	54%	0%	46%
1ADIF000.86	05/22/07	D6844	02070008	24	82	21%	29%	0%	50%
1ADIF000.86	06/19/07	D6907	02070008	24	170	4%	42%	4%	50%
1ADIF000.86	07/16/07	D6923	02070008	24	58	4%	84%	0%	12%
1ADIF000.86	08/28/07	D6976	02070008	24	140	8%	4%	12%	76%
1ADIF000.86	09/17/07	D6991	02070008	24	185	0%	0%	0%	100%
1ADIF000.86	10/30/07	D7042	02070008	24	104	0%	58%	0%	42%
1ADIF000.86	11/27/07	D7055	02070008	24	94	33%	46%	0%	21%
1ADIF000.86	12/20/07	D7122	02070008	24	104	0%	62%	0%	38%
1ADIF000.86	01/30/08	D7161	02070008	16	30	0%	88%	0%	12%
1ADIF000.86	02/26/08	D7196	02070008	10	18	0%	70%	0%	30%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

5.3 Results for Tidewater Region

The results of the water quality analyses for VADEQ's Tidewater Region (Figure 5.3) are reported in the following tables. Table 5.13 indicates the number of samples analyzed in the 2007-2008 sampling phase. Bacteria enumerations, optical brighteners concentrations and BST analysis results are reported in Table 5.14 through 5.21.

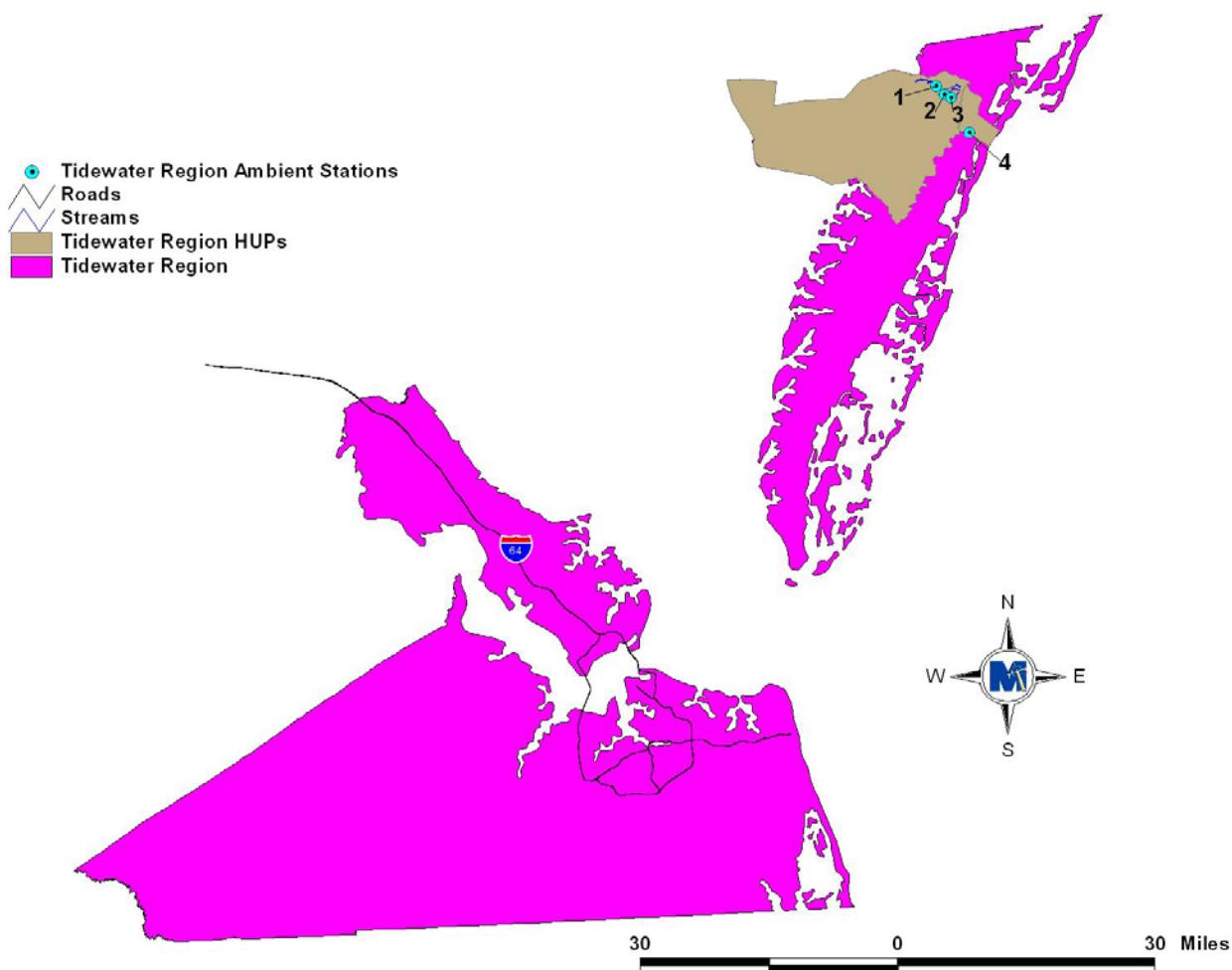


Figure 5.3 Bacterial sampling stations in Tidewater Region.

Table 5.13 Summary of bacterial sampling in VADEQ's Tidewater Region.

Station Number	Station ID	HUC	Stream Name	# of Samples Received	% Violations for <i>E. Coli</i>
1	7-HLD002.67	02080109	Holdens Creek	12	58%
2	7-SBB000.17	02080109	Sandy Botton Branch	12	50%
3	7-XAZ00.30	02080109	Unnamed trib to Sandy Bottom Branch	12	33%
4	7-PET000.80	02080110	Petit Branch	12	42%

Table 5.14 Bacterial Enumeration for Holdens Creek at Station 7-HLD002.67.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
7HLD002.67	4/10/2007	D6813	4/11/2007	140	B	140.6		4/12/2007	MAF
7HLD002.67	5/29/2007	D6854	5/30/2007	540		168.4		5/31/2007	MAF
7HLD002.67	6/19/2007	D6903	6/20/2007	420		160.9		6/21/2007	MAF
7HLD002.67	7/16/2007	D6925	7/17/2007	440		186.3		7/19/2007	MAF
7HLD002.67	8/27/2007	D6966	8/28/2007	319	A	186.7		8/31/2007	MAF
7HLD002.67	9/25/2007	D7007	9/26/2007	370		179.6		9/28/2007	MAF
7HLD002.67	10/30/2007	D7039	10/31/2007	274	A	168.2		11/2/2007	MAF
7HLD002.67	11/26/2007	D7052	11/27/2007	298	A	124.9		11/30/2007	MAF
7HLD002.67	12/11/2007	D7086	12/12/2007	26	B	116.7		12/14/2007	MAF
7HLD002.67	1/28/2008	D7157	1/29/2008	118		138.8		2/4/2008	MAF
7HLD002.67	2/26/2008	D7198	2/27/2008	82		156.5		3/3/2008	MAF
7HLD002.67	3/13/2008	D7210	3/14/2008	90		168.5		3/17/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.15 Bacterial Source Tracking for Holdens Creek at Station 7-HLD002.67.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
7-HLD002.67	4/10/07	D6813	02080109	23	140	49%	4%	17%	30%
7-HLD002.67	5/29/07	D6854	02080109	17	540	53%	6%	29%	12%
7-HLD002.67	6/19/07	D6903	02080109	21	420	39%	33%	14%	14%
7-HLD002.67	7/16/07	D6925	02080109	24	440	17%	17%	45%	21%
7-HLD002.67	8/27/07	D6966	02080109	24	319	0%	12%	59%	29%
7-HLD002.67	9/25/07	D7007	02080109	24	370	38%	38%	20%	4%
7-HLD002.67	10/30/07	D7039	02080109	22	274	27%	23%	41%	9%
7-HLD002.67	11/26/07	D7052	02080109	24	298	55%	12%	8%	25%
7-HLD002.67	12/11/07	D7086	02080109	13	26	46%	31%	23%	0%
7-HLD002.67	1/28/08	D7157	02080109	24	118	55%	12%	8%	25%
7-HLD002.67	2/26/08	D7198	02080109	21	82	14%	29%	19%	38%
7-HLD002.67	3/13/08	D7210	02080109	24	90	4%	38%	12%	46%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.16 Bacterial Enumeration for Sandy Bottom Branch 7-SBB000.17.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
7SBB000.17	4/10/2007	D6814	4/11/2007	270		172.3		4/12/2007	MAF
7SBB000.17	5/29/2007	D6855	5/30/2007	220		192		5/31/2007	MAF
7SBB000.17	6/19/2007	D6904	6/20/2007	250		181.4		6/21/2007	MAF
7SBB000.17	7/16/2007	D6926	7/17/2007	480		237.8		7/19/2007	MAF
7SBB000.17	8/27/2007	D6967	8/28/2007	248	A	242.9		8/31/2007	MAF
7SBB000.17	9/25/2007	D7008	9/26/2007	1590	B	263.9		9/28/2007	MAF
7SBB000.17	10/30/2007	D7040	10/31/2007	221	A	190.8		11/2/2007	MAF
7SBB000.17	11/26/2007	D7053	11/27/2007	68		191.2		11/30/2007	MAF
7SBB000.17	12/11/2007	D7087	12/12/2007	36	B	217.5		12/14/2007	MAF
7SBB000.17	1/28/2008	D7158	1/29/2008	1010	B	203.9		2/4/2008	MAF
7SBB000.17	2/26/2008	D7199	2/27/2008	20	B	193.1		3/3/2008	MAF
7SBB000.17	3/13/2008	D7211	3/14/2008	16	B	192.3		3/17/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.17 Bacterial Source Tracking for Sandy Bottom Branch 7-SBB000.17.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
7-SBB000.17	4/10/07	D6814	02080109	22	270	23%	9%	23%	45%
7-SBB000.17	5/29/07	D6855	02080109	11	220	55%	9%	18%	18%
7-SBB000.17	6/19/07	D6904	02080109	9	250	22%	0%	78%	0%
7-SBB000.17	7/16/07	D6926	02080109	24	480	17%	50%	29%	4%
7-SBB000.17	8/27/07	D6967	02080109	24	248	38%	17%	45%	0%
7-SBB000.17	9/25/07	D7008	02080109	24	1590	0%	38%	62%	0%
7-SBB000.17	10/30/07	D7040	02080109	8	221	25%	50%	25%	0%
7-SBB000.17	11/26/07	D7053	02080109	24	68	21%	50%	21%	8%
7-SBB000.17	12/11/07	D7087	02080109	19	36	37%	32%	5%	26%
7-SBB000.17	1/28/08	D7158	02080109	24	1010	12%	33%	0%	55%
7-SBB000.17	2/26/08	D7199	02080109	3	20	0%	0%	67%	33%
7-SBB000.17	3/13/08	D7211	02080109	8	16	50%	12%	0%	38%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.18 Bacterial Enumeration for Unnamed Tributary to Sandy Bottom Branch at Station 7-AXZ000.30.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
7XAZ000.30	4/10/2007	D6815	4/11/2007	350		165.3		4/12/2007	MAF
7XAZ000.30	5/29/2007	D6856	5/30/2007	210		198.4		5/31/2007	MAF
7XAZ000.30	6/19/2007	D6905	6/20/2007	154		194		6/21/2007	MAF
7XAZ000.30	7/16/2007	D6927	7/17/2007	128		239.3		7/19/2007	MAF
7XAZ000.30	8/27/2007	D6968	8/28/2007	104		246.9		8/31/2007	MAF
7XAZ000.30	9/25/2007	D7009	9/26/2007	940	B	292.6		9/28/2007	MAF
7XAZ000.30	10/30/2007	D7041	10/31/2007	265	A	205.9		11/2/2007	MAF
7XAZ000.30	11/26/2007	D7054	11/27/2007	52		209.4		11/30/2007	MAF
7XAZ000.30	12/11/2007	D7088	12/12/2007	32	B	219.1		12/14/2007	MAF
7XAZ000.30	1/28/2008	D7159	1/29/2008	980	B	194.5		2/4/2008	MAF
7XAZ000.30	2/26/2008	D7200	2/27/2008	20	B	186.8		3/3/2008	MAF
7XAZ000.30	3/13/2008	D7212	3/14/2008	46		180.1		3/17/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.19 Bacterial Source Tracking for Unnamed Tributary to Sandy Bottom Branch at Station 7-AXZ000.30.

VAEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
7-XAZ000.30	4/10/07	D6815	02080109	21	350	19%	33%	24%	24%
7-XAZ000.30	5/29/07	D6856	02080109	5	210	60%	0%	20%	20%
7-XAZ000.30	6/19/07	D6905	02080109	23	154	0%	56%	35%	9%
7-XAZ000.30	7/16/07	D6927	02080109	24	128	4%	54%	38%	4%
7-XAZ000.30	8/27/07	D6968	02080109	24	104	4%	17%	67%	12%
7-XAZ000.30	9/25/07	D7009	02080109	24	940	8%	59%	33%	0%
7-XAZ000.30	10/30/07	D7041	02080109	17	265	12%	29%	47%	12%
7-XAZ000.30	11/26/07	D7054	02080109	24	52	12%	42%	25%	21%
7-XAZ000.30	12/11/07	D7088	02080109	19	32	26%	32%	21%	21%
7-XAZ000.30	1/28/08	D7159	02080109	20	980	10%	60%	5%	25%
7-XAZ000.30	2/26/08	D7200	02080109	11	20	9%	19%	36%	36%
7-XAZ000.30	3/13/08	D7212	02080109	24	46	25%	12%	12%	51%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.20 Bacterial Enumeration for Petit Branch at Station 7-PET000.80.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
7PET000.80	4/10/2007	D6812	4/11/2007	38	B	75.6		4/12/2007	7PET000.80
7PET000.80	5/29/2007	D6853	5/30/2007	152		89.7		5/31/2007	7PET000.80
7PET000.80	6/19/2007	D6902	6/20/2007	1600	B	83.8		6/21/2007	7PET000.80
7PET000.80	7/16/2007	D6924	7/17/2007	570		83.2		7/19/2007	7PET000.80
7PET000.80	8/27/2007	D6965	8/28/2007	740		95.1		8/31/2007	7PET000.80
7PET000.80	9/25/2007	D7006	9/26/2007	540		74.9		9/28/2007	7PET000.80
7PET000.80	10/30/2007	D7038	10/31/2007	166	A	74.3		11/2/2007	7PET000.80
7PET000.80	11/26/2007	D7051	11/27/2007	54		82.2		11/30/2007	7PET000.80
7PET000.80	12/11/2007	D7085	12/12/2007	34	B	77.7		12/14/2007	7PET000.80
7PET000.80	1/28/2008	D7156	1/29/2008	330		85.7		2/4/2008	7PET000.80
7PET000.80	2/26/2008	D7197	2/27/2008	140		101.4		3/3/2008	7PET000.80
7PET000.80	3/13/2008	D7209	3/14/2008	96		101.6		3/17/2008	7PET000.80

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.21 Bacterial Source Tracking for Petit Branch at Station 7-PET000.80.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
7PET000.80	4/10/07	D6812	02080110	24	38	33%	30%	4%	33%
7PET000.80	5/29/07	D6853	02080110	10	152	10%	80%	10%	0%
7PET000.80	6/19/07	D6902	02080110	24	1,600	12%	0%	88%	0%
7PET000.80	7/16/07	D6924	02080110	24	570	0%	0%	100%	0%
7PET000.80	8/27/07	D6965	02080110	24	740	8%	0%	92%	0%
7PET000.80	9/25/07	D7006	02080110	21	540	24%	47%	29%	0%
7PET000.80	10/30/07	D7038	02080110	24	166	17%	25%	54%	4%
7PET000.80	11/26/07	D7051	02080110	23	54	35%	17%	22%	26%
7PET000.80	12/11/07	D7085	02080110	17	34	24%	18%	6%	52%
7PET000.80	1/28/08	D7156	02080110	23	330	52%	26%	13%	9%
7PET000.80	2/26/08	D7197	02080110	20	140	30%	60%	0%	10%
7PET000.80	3/13/08	D7209	02080110	24	96	42%	50%	4%	4%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

5.4 Results for Piedmont Region

The results of the water quality analyses for VADEQ's Piedmont Region (Figure 5.4) are reported in the following tables. Table 5.22 indicates the number of samples analyzed in the 2007-2008 sampling phase. Bacteria enumerations, optical brighteners concentrations and BST analysis results are reported in Table 5.23 through 5.58.

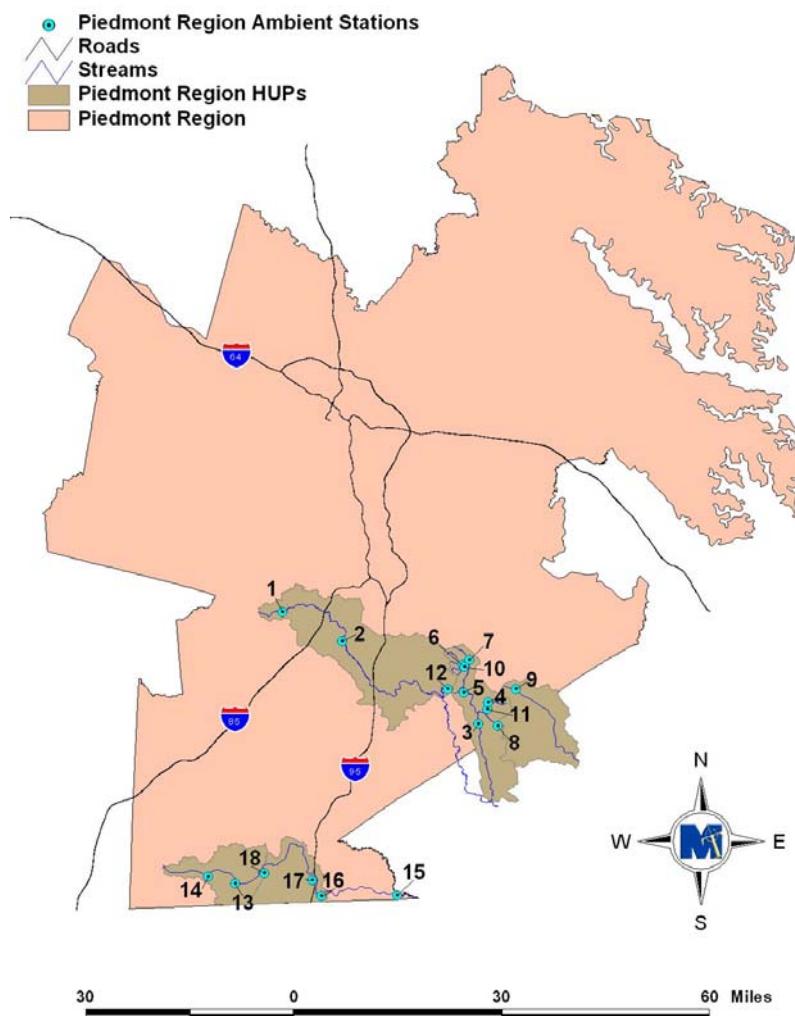


Figure 5.4 Bacterial sampling stations in Piedmont Region.

Table 5.22 Summary of bacterial sampling in VADEQ's Piedmont Region.

Station Number	Station ID	HUC	Stream Name	# of Samples Received	% Violations for <i>E. Coli</i>
1	5AHRA016.25	03010201	Hatcher Run	12	9%
2	5AROW013.14	03010201	Rowanty Creek	12	9%
3	5AASM013.36	03010201	Assamoosick Sw	12	0%
4	5AXDX001.35	03010201	Unnamed trib to Seacorrie Swamp	6	50%
5	5AASM018.62	03010201	Assamoosick Sw	1	0%
6	5AASM021.22	03010201	Assamoosick Sw	11	9%
7	5ABLS001.58	03010201	Black Swamp	12	27%
8	5AGMN000.54	03010201	German Swamp	11	18%
9	5ANBT001.26	03010201	Nebblets Mill Run	11	9%
10	5APNS001.15	03010201	Pigeon Swamp	12	0%
11	5ASRE005.89	03010201	Seacorrie Swamp	11	27%
12	5AXDV000.46	03010201	Unnamed trib to Nebblets Mill Run	11	45%
13	5ARSK003.08	03010204	Rattlesnake Creek	12	8%
14	5ARSK009.28	03010204	Rattlesnake Creek	12	8%
15	5AFON001.46	03010204	Fontaine Creek	8	38%
16	5AFON014.38	03010204	Fontaine Creek	12	0%
17	5AFON022.04	03010204	Fontaine Creek	12	0%
18	5AFON037.89	03010204	Fontaine Creek	13	8%

Table 5.23 Bacterial Enumeration for Hatcher Run at Station 5AHRA016.25.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5AHRA016.25	1/16/2007	D6688	1/17/2007	14	B	74.2		1/22/2007	MAF
5AHRA016.25	2/12/2007	D6728	2/13/2007	2	B	57.5		2/16/2007	MAF
5AHRA016.25	3/6/2007	D6756	3/7/2007	40	B	68.8		3/9/2007	MAF
5AHRA016.25	4/2/2007	D6797	4/3/2007	30	B	82.6		4/4/2007	MAF
5AHRA016.25	5/15/2007	D6842	5/16/2007	62		91.2		5/17/2007	MAF
5AHRA016.25	6/26/2007	D6908	6/27/2007	168	A	78.5		6/29/2007	MAF
5AHRA016.25	7/24/2007	D6940	7/25/2007	250		89.5		7/27/2007	MAF
5AHRA016.25	8/7/2007	D6948	8/8/2007	36	B	110.8		8/9/2007	MAF
5AHRA016.25	9/17/2007	D6992	9/18/2007	34	B	116.4		9/21/2007	MAF
5AHRA016.25	10/2/2007	D7014	10/3/2007	4	B	109.3		10/5/2007	MAF
5AHRA016.25	11/28/2007	D7077	11/29/2007	6	B	98.3		11/30/2007	MAF
5AHRA016.25	12/19/2007	D7120	12/20/2007	66		87.7		12/24/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.24 Bacterial Source Tracking for Hatcher Run at Station 5AHRA016.25.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5AHRA016.25	01/16/07	D6688	03010201	9	14	89%	0%	11%	0%
5AHRA016.25	02/12/07	D6728	03010201	NVI	2	NVI	NVI	NVI	NVI
5AHRA016.25	03/06/07	D6756	03010201	5	40	40%	0%	40%	20%
5AHRA016.25	04/02/07	D6797	03010201	18	30	44%	0%	44%	12%
5AHRA016.25	05/15/07	D6842	03010201	20	62	45%	25%	10%	20%
5AHRA016.25	06/26/07	D6908	03010201	24	168	63%	12%	21%	4%
5AHRA016.25	07/24/07	D6940	03010201	24	250	75%	4%	17%	4%
5AHRA016.25	08/07/07	D6948	03010201	24	36	25%	12%	42%	21%
5AHRA016.25	09/17/07	D6992	03010201	16	34	69%	12%	0%	19%
5AHRA016.25	10/02/07	D7014	03010201	2	4	50%	0%	50%	0%
5AHRA016.25	11/28/07	D7077	03010201	3	6	100%	0%	0%	0%
5AHRA016.25	12/19/07	D7120	03010201	24	66	50%	0%	50%	0%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.25 Bacterial Enumeration for Rowanty Creek at Station 5AROW013.14.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5AROW013.14	1/16/2007	D6689	1/17/2007	76		99.3		1/22/2007	MAF
5AROW013.14	2/12/2007	D6727	2/13/2007	16	B	74.5		2/16/2007	MAF
5AROW013.14	3/6/2007	D6757	3/7/2007	36	B	90		3/9/2007	MAF
5AROW013.14	4/2/2007	D6798	4/3/2007	200		121.4		4/4/2007	MAF
5AROW013.14	5/15/2007	D6843	5/16/2007	72		133.1		5/17/2007	MAF
5AROW013.14	6/26/2007	D6909	6/27/2007	272	A	113.8		6/29/2007	MAF
5AROW013.14	7/24/2007	D6941	7/25/2007	14	B	120.5		7/27/2007	MAF
5AROW013.14	8/7/2007	D6949	8/8/2007	44		154.8		8/9/2007	MAF
5AROW013.14	9/17/2007	D6993	9/18/2007	62		174.9		9/21/2007	MAF
5AROW013.14	10/2/2007	D7015	10/3/2007	30	B	161.6		10/5/2007	MAF
5AROW013.14	11/28/2007	D7078	11/29/2007	4	B	159.5		11/30/2007	MAF
5AROW013.14	12/19/2007	D7121	12/20/2007	92		120.3		12/24/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.26 Bacterial Source Tracking for Rowanty Creek at Station 5AROW013.14.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5AROW013.14	01/16/07	D6689	03010201	17	76	6%	0%	0%	94%
5AROW013.14	02/12/07	D6727	03010201	9	16	22%	11%	0%	67%
5AROW013.14	03/06/07	D6757	03010201	20	36	25%	40%	10%	25%
5AROW013.14	04/02/07	D6798	03010201	24	200	54%	0%	0%	46%
5AROW013.14	05/15/07	D6843	03010201	20	72	15%	15%	0%	70%
5AROW013.14	06/26/07	D6909	03010201	16	272	6%	12%	51%	31%
5AROW013.14	07/24/07	D6941	03010201	7	14	86%	14%	0%	0%
5AROW013.14	08/07/07	D6949	03010201	24	44	33%	4%	12%	51%
5AROW013.14	09/17/07	D6993	03010201	20	62	75%	0%	5%	20%
5AROW013.14	10/02/07	D7015	03010201	12	30	42%	8%	25%	25%
5AROW013.14	11/28/07	D7078	03010201	4	4	100%	0%	0%	0%
5AROW013.14	12/19/07	D7121	03010201	24	92	76%	8%	12%	4%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.27 Bacterial Enumeration for Assamoosick Sw at Station 5AASM013.36.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5AASM013.36	1/17/2007	D6698	1/17/2007	94		151.4		1/22/2007	MAF
5AASM013.36	2/6/2007	D6723	2/7/2006	28	B	101.1		2/9/2007	MAF
5AASM013.36	3/19/2007	D6767	3/20/2007	136		139.8		3/21/2007	MAF
5AASM013.36	4/4/2007	D6811	4/5/2007	36	B	166.3		4/6/2007	MAF
5AASM013.36	5/8/2007	D6841	5/9/2007	60		174.6		5/11/2007	MAF
5AASM013.36	6/13/2007	D6889	6/14/2007	146		214.9		6/15/2007	MAF
5AASM013.36	7/5/2007	D6912	7/6/2007	4	B	228.3		7/9/2007	MAF
5AASM013.36	8/13/2007	D6953	8/14/2007	32	B	213.4		8/15/2007	MAF
5AASM013.36	9/4/2007	D6978	9/5/2007	6	B	186.4		9/7/2007	MAF
5AASM013.36	10/1/2007	D7013	10/2/2007	4	B	189.7		10/5/2007	MAF
5AASM013.36	11/28/2007	D7074	11/29/2007	16	B	193.5		11/30/2007	MAF
5AASM013.36	12/12/2007	D7093	12/13/2007	52		188.6		12/14/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.28 Bacterial Source Tracking for Assamoosick Sw at Station 5AASM013.36.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5AASM013.36	01/17/07	D6698	03010201	18	94	28%	0%	0%	72%
5AASM013.36	02/06/07	D6723	03010201	5	28	20%	40%	20%	20%
5AASM013.36	03/19/07	D6767	03010201	24	136	54%	4%	21%	21%
5AASM013.36	04/04/07	D6811	03010201	21	36	42%	5%	29%	24%
5AASM013.36	05/08/07	D6841	03010201	22	60	67%	14%	5%	14%
5AASM013.36	06/13/07	D6889	03010201	17	146	24%	6%	18%	52%
5AASM013.36	07/05/07	D6912	03010201	1	4	0%	0%	100%	0%
5AASM013.36	08/13/07	D6953	03010201	2	32	0%	0%	50%	50%
5AASM013.36	09/04/07	D6978	03010201	2	6	100%	0%	0%	0%
5AASM013.36	10/01/07	D7013	03010201	2	4	0%	50%	50%	0%
5AASM013.36	11/28/07	D7074	03010201	10	16	40%	20%	40%	0%
5AASM013.36	12/12/07	D7093	03010201	20	52	85%	10%	5%	0%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.29 Bacterial Enumeration for Unnamed tributary to Seacorrie Swamp at Station 5AXDX001.35.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5AXDX001.35	1/17/2007	D6696	1/17/2007	58		142		1/22/2007	MAF
5AXDX001.35	2/6/2007	D6726	2/7/2006	22	B	134.7		2/9/2007	MAF
5AXDX001.35	3/19/2007	D6779	3/20/2007	86		134.6		3/21/2007	MAF
5AXDX001.35	5/8/2007	D6838	5/9/2007	730		130.5		5/11/2007	MAF
5AXDX001.35	12/17/2007	D7103	12/18/2007	>2001	L	159.9		12/20/2007	MAF
5AXDX001.35	12/26/2007	D7125	12/27/2007	>2001	L	132.9		12/28/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range.

L: Off-scale high. Actual value not known, but known to be greater than value shown.

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.30 Bacterial Source Tracking for Unnamed tributary to Seacorrie Swamp at Station 5AXDX001.35.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5AXDX001.35	01/17/07	D6696	03010201	21	58	52%	5%	0%	43%
5AXDX001.35	02/06/07	D6726	03010201	6	22	33%	0%	0%	67%
5AXDX001.35	03/19/07	D6779	03010201	22	86	27%	37%	18%	18%
5AXDX001.35	05/08/07	D6838	03010201	22	730	59%	27%	5%	9%
5AXDX001.35	12/17/07	D7103	03010201	24	>2,001	51%	25%	12%	12%
5AXDX001.35	12/26/07	D7125	03010201	24	>2,001	8%	0%	4%	88%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.31 Bacterial Enumeration for Assamoosick Sw at Station 5AASM018.62.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5AASM018.62	3/19/2007	D6777	3/20/2007	104		134.3		3/21/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.32 Bacterial Source Tracking for Assamoosick Sw at Station 5AASM018.62.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5AASM018.62	03/19/07	D6777	03010201	24	104	55%	4%	12%	29%

BOLD type indicates a statistically

*NVI - No Viable isolates

Table 5.33 Bacterial Enumeration for Assamoosick Sw at Station 5AASM021.22.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5AASM021.22	1/17/2007	D6694	1/17/2007	60		154.6		1/22/2007	MAF
5AASM021.22	2/6/2007	D6724	2/7/2006	12	B	121.1		2/9/2007	MAF
5AASM021.22	4/3/2007	D6799	4/4/2007	48		173.9		4/6/2007	MAF
5AASM021.22	5/8/2007	D6836	5/9/2007	118		210.6		5/11/2007	MAF
5AASM021.22	6/13/2007	D6890	6/14/2007	430		211.8		6/15/2007	MAF
5AASM021.22	7/5/2007	D6910	7/6/2007	34	B	204.2		7/9/2007	MAF
5AASM021.22	8/13/2007	D6954	8/14/2007	12	B	288.6		8/15/2007	MAF
5AASM021.22	9/4/2007	D6979	9/5/2007	86		308		9/7/2007	MAF
5AASM021.22	10/1/2007	D7012	10/2/2007	24	B	299.2		10/5/2007	MAF
5AASM021.22	11/27/2007	D7064	11/28/2007	108		247.8		11/30/2007	MAF
5AASM021.22	12/12/2007	D7090	12/13/2007	142		220.6		12/14/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.34 Bacterial Source Tracking for Assamoosick Sw at Station 5AASM021.22.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5AASM021.22	01/17/07	D6694	03010201	14	60	29%	0%	7%	64%
5AASM021.22	02/06/07	D6724	03010201	1	12	0%	0%	0%	100%
5AASM021.22	04/03/07	D6799	03010201	24	48	46%	4%	0%	50%
5AASM021.22	05/08/07	D6836	03010201	18	118	33%	11%	28%	28%
5AASM021.22	06/13/07	D6890	03010201	10	430	20%	30%	30%	20%
5AASM021.22	07/05/07	D6910	03010201	22	34	68%	0%	9%	23%
5AASM021.22	08/13/07	D6954	03010201	4	12	25%	0%	25%	50%
5AASM021.22	09/04/07	D6979	03010201	20	86	0%	0%	85%	15%
5AASM021.22	10/01/07	D7012	03010201	11	24	0%	0%	82%	18%
5AASM021.22	11/27/07	D7064	03010201	15	108	27%	7%	13%	53%
5AASM021.22	12/12/07	D7090	03010201	20	142	85%	5%	0%	10%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.35 Bacterial Enumeration for Black Swamp at Station 5ABLS001.58.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5ABLS001.58	1/16/2007	D6690	1/17/2007	8	B	252.5		1/22/2007	MAF
5ABLS001.58	2/26/2007	D6744	2/27/2007	28	B	295		2/28/2007	MAF
5ABLS001.58	3/5/2007	D6751	3/6/2007	8	B	247.5		3/7/2007	MAF
5ABLS001.58	4/2/2007	D6793	4/3/2007	50		439.7		4/4/2007	MAF
5ABLS001.58	5/1/2007	D6828	5/2/2007	42		443.9		5/4/2007	MAF
5ABLS001.58	6/11/2007	D6869	6/12/2007	10	B	59.6		6/15/2007	MAF
5ABLS001.58	7/9/2007	D6913	7/10/2007	116		262.6		7/12/2007	MAF
5ABLS001.58	8/8/2007	D6950	8/9/2007	260		500		8/10/2007	MAF
5ABLS001.58	9/10/2007	D6981	9/11/2007	600		130.3		9/14/2007	MAF
5ABLS001.58	10/2/2007	D7016	10/3/2007	261		500		10/5/2007	MAF
5ABLS001.58	11/27/2007	D7069	11/28/2007	58		500		11/30/2007	MAF
5ABLS001.58	12/18/2007	D7116	12/19/2007	112		500		12/21/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.36 Bacterial Source Tracking for Black Swamp at Station 5ABLS001.58.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5ABLS001.58	01/16/07	D6690	03010201	3	8	34%	0%	33%	33%
5ABLS001.58	02/26/07	D6744	03010201	NVI	28	NVI	NVI	NVI	NVI
5ABLS001.58	03/05/07	D6751	03010201	NVI	8	NVI	NVI	NVI	NVI
5ABLS001.58	04/02/07	D6793	03010201	24	50	8%	51%	8%	33%
5ABLS001.58	05/01/07	D6828	03010201	24	42	4%	12%	4%	80%
5ABLS001.58	06/11/07	D6869	03010201	8	10	75%	25%	0%	0%
5ABLS001.58	07/09/07	D6913	03010201	24	116	50%	17%	29%	4%
5ABLS001.58	08/08/07	D6950	03010201	24	260	46%	17%	4%	33%
5ABLS001.58	09/10/07	D6981	03010201	24	600	8%	4%	88%	0%
5ABLS001.58	10/02/07	D7016	03010201	24	261	29%	42%	29%	0%
5ABLS001.58	11/27/07	D7069	03010201	23	58	9%	9%	69%	13%
5ABLS001.58	12/18/07	D7116	03010201	24	112	63%	8%	21%	8%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.37 Bacterial Enumeration for German Swamp at Station 5AGMN000.54.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5AGMN000.54	1/17/2007	D6697	1/17/2007	38	B	126.4		1/22/2007	MAF
5AGMN000.54	2/6/2007	D6720	2/7/2006	40	B	84.2		2/9/2007	MAF
5AGMN000.54	3/19/2007	D6766	3/20/2007	34	B	118		3/21/2007	MAF
5AGMN000.54	4/4/2007	D6810	4/5/2007	22	B	129.9		4/6/2007	MAF
5AGMN000.54	5/8/2007	D6840	5/9/2007	20	B	145.5		5/11/2007	MAF
5AGMN000.54	6/13/2007	D6888	6/14/2007	42		147.5		6/15/2007	MAF
5AGMN000.54	9/4/2007	D6977	9/5/2007	173	A	142.2		9/7/2007	MAF
5AGMN000.54	11/28/2007	D7073	11/29/2007	12	B	184.9		11/30/2007	MAF
5AGMN000.54	12/12/2007	D7092	12/13/2007	10	B	161.3		12/14/2007	MAF
5AGMN000.54	12/17/2007	D7102	12/18/2007	310		162.9		12/20/2007	MAF
5AGMN000.54	12/26/2007	D7124	12/27/2007	680		141.3		12/28/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.38 Bacterial Source Tracking for German Swamp at Station 5AGMN000.54.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5AGMN000.54	01/17/07	D6697	03010201	13	38	31%	0%	0%	69%
5AGMN000.54	02/06/07	D6720	03010201	3	40	67%	0%	33%	0%
5AGMN000.54	03/19/07	D6766	03010201	18	34	28%	6%	22%	44%
5AGMN000.54	04/04/07	D6810	03010201	15	22	7%	0%	27%	66%
5AGMN000.54	05/08/07	D6840	03010201	12	20	100%	0%	0%	0%
5AGMN000.54	06/13/07	D6888	03010201	13	42	69%	8%	0%	23%
5AGMN000.54	09/04/07	D6977	03010201	15	173	13%	0%	74%	13%
5AGMN000.54	11/28/07	D7073	03010201	10	12	50%	30%	20%	0%
5AGMN000.54	12/12/07	D7092	03010201	5	10	60%	0%	40%	0%
5AGMN000.54	12/17/07	D7102	03010201	24	310	38%	17%	45%	0%
5AGMN000.54	12/26/07	D7124	03010201	24	680	72%	12%	4%	12%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.39 Bacterial Enumeration for Nebletts Mill Run at Station 5ANBT001.26.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5ANBT001.26	1/16/2007	D6693	1/17/2007	32	B	121.8		1/22/2007	MAF
5ANBT001.26	2/26/2007	D6747	2/27/2007	38	B	94.4		2/28/2007	MAF
5ANBT001.26	3/5/2007	D6754	3/6/2007	10	B	99.7		3/7/2007	MAF
5ANBT001.26	4/2/2007	D6796	4/3/2007	36	B	132.9		4/4/2007	MAF
5ANBT001.26	5/1/2007	D6831	5/2/2007	26	B	159.8		5/4/2007	MAF
5ANBT001.26	6/11/2007	D6872	6/12/2007	38	B	179.1		6/15/2007	MAF
5ANBT001.26	7/9/2007	D6915	7/10/2007	28	B	166.9		7/12/2007	MAF
5ANBT001.26	8/8/2007	D6952	8/9/2007	1	U	163.1		8/10/2007	MAF
5ANBT001.26	9/10/2007	D6983	9/11/2007	4	B	160.8		9/14/2007	MAF
5ANBT001.26	11/27/2007	D7072	11/28/2007	22	B	198		11/30/2007	MAF
5ANBT001.26	12/18/2007	D7119	12/19/2007	280		171.9		12/21/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.40 Bacterial Source Tracking for Nebletts Mill Run at Station 5ANBT001.26.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5ANBT001.26	01/16/07	D6693	03010201	4	32	50%	25%	0%	25%
5ANBT001.26	02/26/07	D6747	03010201	17	38	12%	6%	35%	47%
5ANBT001.26	03/05/07	D6754	03010201	5	10	20%	0%	80%	0%
5ANBT001.26	04/02/07	D6796	03010201	22	36	36%	5%	45%	14%
5ANBT001.26	05/01/07	D6831	03010201	13	26	0%	23%	15%	62%
5ANBT001.26	06/11/07	D6872	03010201	16	38	69%	12%	19%	0%
5ANBT001.26	07/09/07	D6915	03010201	10	28	80%	20%	0%	0%
5ANBT001.26	08/08/07	D6952	03010201	NVI	1	NVI	NVI	NVI	NVI
5ANBT001.26	09/10/07	D6983	03010201	2	4	100%	0%	0%	0%
5ANBT001.26	11/27/07	D7072	03010201	10	22	60%	10%	20%	10%
5ANBT001.26	12/18/07	D7119	03010201	24	280	63%	8%	21%	8%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.41 Bacterial Enumeration for Pigeon Swamp at Station 5APNS001.15.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5APNS001.15	1/16/2007	D6691	1/17/2007	30	B	137.5		1/22/2007	MAF
5APNS001.15	2/26/2007	D6745	2/27/2007	6	B	109.1		2/28/2007	MAF
5APNS001.15	3/5/2007	D6752	3/6/2007	4	B	117.4		3/7/2007	MAF
5APNS001.15	4/2/2007	D6794	4/3/2007	24	B	133.9		4/4/2007	MAF
5APNS001.15	5/1/2007	D6829	5/2/2007	114		150.5		5/4/2007	MAF
5APNS001.15	6/11/2007	D6870	6/12/2007	20	B	129.6		6/15/2007	MAF
5APNS001.15	7/9/2007	D6914	7/10/2007	26	B	135		7/12/2007	MAF
5APNS001.15	8/8/2007	D6951	8/9/2007	4	B	120.3		8/10/2007	MAF
5APNS001.15	9/10/2007	D6982	9/11/2007	10	B	175.3		9/14/2007	MAF
5APNS001.15	10/2/2007	D7017	10/3/2007	8	B	113		10/5/2007	MAF
5APNS001.15	11/27/2007	D7070	11/28/2007	12	B	117.1		11/30/2007	MAF
5APNS001.15	12/18/2007	D7117	12/19/2007	32	B	100.5		12/21/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.42 Bacterial Source Tracking for Pigeon Swamp at Station 5APNS001.15.

VAEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5APNS001.15	01/16/07	D6691	03010201	10	30	30%	10%	30%	30%
5APNS001.15	02/26/07	D6745	03010201	NVI	6	NVI	NVI	NVI	NVI
5APNS001.15	03/05/07	D6752	03010201	1	4	0%	0%	0%	100%
5APNS001.15	04/02/07	D6794	03010201	16	24	31%	12%	0%	57%
5APNS001.15	05/01/07	D6829	03010201	23	114	4%	35%	22%	39%
5APNS001.15	06/11/07	D6870	03010201	11	20	73%	27%	0%	0%
5APNS001.15	07/09/07	D6914	03010201	13	26	70%	15%	15%	0%
5APNS001.15	08/08/07	D6951	03010201	2	4	50%	0%	50%	0%
5APNS001.15	09/10/07	D6982	03010201	2	10	100%	0%	0%	0%
5APNS001.15	10/02/07	D7017	03010201	5	8	40%	20%	20%	20%
5APNS001.15	11/27/07	D7070	03010201	6	12	17%	33%	50%	0%
5APNS001.15	12/18/07	D7117	03010201	20	32	60%	15%	5%	20%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.43 Bacterial Enumeration for Seacorrie Swamp at Station 5ASRE005.89.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5ASRE005.89	2/6/2007	D6721	2/7/2006	1	U	133.1		2/9/2007	MAF
5ASRE005.89	3/19/2007	D6780	3/20/2007	14	B	151.8		3/21/2007	MAF
5ASRE005.89	4/3/2007	D6800	4/4/2007	10	B	116.3		4/6/2007	MAF
5ASRE005.89	5/8/2007	D6839	5/9/2007	16	B	157.6		5/11/2007	MAF
5ASRE005.89	6/13/2007	D6891	6/14/2007	6	B	116.9		6/15/2007	MAF
5ASRE005.89	7/5/2007	D6911	7/6/2007	1	U	95.2		7/9/2007	MAF
5ASRE005.89	9/4/2007	D6980	9/5/2007	440		168.4		9/7/2007	MAF
5ASRE005.89	11/27/2007	D7065	11/28/2007	10	B	99.7		11/30/2007	MAF
5ASRE005.89	12/12/2007	D7091	12/13/2007	2	B	78		12/14/2007	MAF
5ASRE005.89	12/17/2007	D7104	12/18/2007	>2001	L	134.3		12/20/2007	MAF
5ASRE005.89	12/26/2007	D7126	12/27/2007	>2001	L	91.2		12/28/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range.

L: Off-scale high. Actual value not known, but known to be greater than value shown.

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.44 Bacterial Source Tracking for Seacorrie Swamp at Station 5ASRE005.89.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5ASRE005.89	02/06/07	D6721	03010201	NVI	1	NVI	NVI	NVI	NVI
5ASRE005.89	03/19/07	D6780	03010201	12	14	17%	33%	8%	42%
5ASRE005.89	04/03/07	D6800	03010201	6	10	33%	0%	67%	0%
5ASRE005.89	05/08/07	D6839	03010201	12	16	42%	33%	17%	8%
5ASRE005.89	06/13/07	D6891	03010201	3	6	33%	0%	0%	67%
5ASRE005.89	07/05/07	D6911	03010201	NVI	1	NVI	NVI	NVI	NVI
5ASRE005.89	09/04/07	D6980	03010201	24	440	88%	4%	8%	0%
5ASRE005.89	11/27/07	D7065	03010201	2	10	50%	50%	0%	0%
5ASRE005.89	12/12/07	D7091	03010201	1	2	100%	0%	0%	0%
5ASRE005.89	12/17/07	D7104	03010201	22	>2,001	49%	23%	23%	5%
5ASRE005.89	12/26/07	D7126	03010201	24	>2,001	33%	12%	0%	55%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.45 Bacterial Enumeration for Unnamed tributary Nebletts Mill Run at Station 5AXDV000.46.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5AXDV000.46	1/16/2007	D6692	1/17/2007	150	B	135.9		1/22/2007	MAF
5AXDV000.46	2/26/2007	D6746	2/27/2007	350		113.8		2/28/2007	MAF
5AXDV000.46	3/5/2007	D6753	3/6/2007	104		89.9		3/7/2007	MAF
5AXDV000.46	3/19/2007	D6781	3/20/2007	98		93.1		3/21/2007	MAF
5AXDV000.46	4/2/2007	D6795	4/3/2007	160	B	132.6		4/4/2007	MAF
5AXDV000.46	5/1/2007	D6830	5/2/2007	200		131.6		5/4/2007	MAF
5AXDV000.46	6/11/2007	D6871	6/12/2007	330		138.3		6/15/2007	MAF
5AXDV000.46	11/27/2007	D7071	11/28/2007	40		144.6		11/30/2007	MAF
5AXDV000.46	12/17/2007	D7101	12/18/2007	700		173.5		12/20/2007	MAF
5AXDV000.46	12/18/2007	D7118	12/19/2007	850	B	143.7		12/21/2007	MAF
5AXDV000.46	12/26/2007	D7123	12/27/2007	1910	B	105.2		12/28/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.46 Bacterial Source Tracking for Unnamed tributary Nebletts Mill Run at Station AXDV000.46.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5AXDV000.46	01/16/07	D6692	03010201	19	150	58%	0%	26%	16%
5AXDV000.46	02/26/07	D6746	03010201	22	350	41%	14%	18%	27%
5AXDV000.46	03/05/07	D6753	03010201	10	104	60%	10%	20%	10%
5AXDV000.46	03/19/07	D6781	03010201	23	98	22%	0%	56%	22%
5AXDV000.46	04/02/07	D6795	03010201	24	160	0%	12%	0%	88%
5AXDV000.46	05/01/07	D6830	03010201	24	200	0%	4%	17%	79%
5AXDV000.46	06/11/07	D6871	03010201	24	330	42%	25%	33%	0%
5AXDV000.46	11/27/07	D7071	03010201	17	40	0%	53%	41%	6%
5AXDV000.46	12/17/07	D7101	03010201	24	700	29%	21%	50%	0%
5AXDV000.46	12/18/07	D7118	03010201	24	850	72%	12%	12%	4%
5AXDV000.46	12/26/07	D7123	03010201	23	1,910	4%	83%	9%	4%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.47 Bacterial Enumeration for Rattlesnake Creek at Station 5ARSK003.08.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5ARSK003.08	1/22/2007	D6699	1/23/2007	200	A	79.9		1/25/2007	MAF
5ARSK003.08	2/28/2007	D6749	3/1/2007	36	B	79.4		3/15/2007	DMT
5ARSK003.08	3/12/2007	D6764	3/13/2007	16	B	100.1		3/14/2007	MAF
5ARSK003.08	4/4/2007	D6808	4/5/2007	30	B	132.2		4/6/2007	MAF
5ARSK003.08	5/1/2007	D6826	5/2/2007	32	B	139.2		5/4/2007	MAF
5ARSK003.08	6/11/2007	D6873	6/12/2007	18	B	127.2		6/15/2007	MAF
5ARSK003.08	7/24/2007	D6942	7/25/2007	14	B	105		7/27/2007	MAF
5ARSK003.08	8/22/2007	D6963	8/23/2007	1030	B	94.2		8/24/2007	MAF
5ARSK003.08	9/26/2007	D7010	9/27/2007	4	B	86		9/28/2007	MAF
5ARSK003.08	10/16/2007	D7024	10/17/2007	40		114.3		10/22/2007	MAF
5ARSK003.08	11/27/2007	D7066	11/28/2007	16	B	77.5		11/30/2007	MAF
5ARSK003.08	12/17/2007	D7099	12/18/2007	88		68.9		12/20/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.48 Bacterial Source Tracking for Rattlesnake Creek 5ARSK003.08.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5ARSK003.08	01/22/07	D6699	03010204	14	200	0%	21%	36%	43%
5ARSK003.08	02/28/07	D6749	03010204	22	36	0%	36%	18%	46%
5ARSK003.08	03/12/07	D6764	03010204	8	16	0%	24%	38%	38%
5ARSK003.08	04/04/07	D6808	03010204	15	30	0%	13%	27%	60%
5ARSK003.08	05/01/07	D6826	03010204	17	32	0%	35%	53%	12%
5ARSK003.08	06/11/07	D6873	03010204	2	18	0%	0%	50%	50%
5ARSK003.08	07/24/07	D6942	03010204	8	14	25%	25%	25%	25%
5ARSK003.08	08/22/07	D6963	03010204	24	1030	12%	25%	0%	63%
5ARSK003.08	09/26/07	D7010	03010204	2	4	50%	0%	0%	50%
5ARSK003.08	10/16/07	D7024	03010204	19	40	100%	0%	0%	0%
5ARSK003.08	11/27/07	D7066	03010204	8	16	38%	12%	25%	25%
5ARSK003.08	12/17/07	D7099	03010204	24	88	33%	25%	25%	17%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.49 Bacterial Enumeration for Rattlesnake Creek at Station 5ARSK009.28.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5ARSK009.28	1/22/2007	D6700	1/23/2007	142		81.4		1/25/2007	MAF
5ARSK009.28	2/28/2007	D6750	3/1/2007	46		79.8		3/15/2007	DMT
5ARSK009.28	3/12/2007	D6765	3/13/2007	2	B	85.5		3/14/2007	MAF
5ARSK009.28	4/4/2007	D6809	4/5/2007	112		116.4		4/6/2007	MAF
5ARSK009.28	5/1/2007	D6827	5/2/2007	36	B	122.5		5/4/2007	MAF
5ARSK009.28	6/11/2007	D6874	6/12/2007	88		129.6		6/15/2007	MAF
5ARSK009.28	7/24/2007	D6943	7/25/2007	4	B	114.7		7/27/2007	MAF
5ARSK009.28	8/22/2007	D6964	8/23/2007	32	B	117.8		8/24/2007	MAF
5ARSK009.28	9/26/2007	D7011	9/27/2007	24	B	108.3		9/28/2007	MAF
5ARSK009.28	10/16/2007	D7025	10/17/2007	74		75.7		10/22/2007	MAF
5ARSK009.28	11/27/2007	D7067	11/28/2007	8	B	82		11/30/2007	MAF
5ARSK009.28	12/17/2007	D7100	12/18/2007	330		66.8		12/20/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.50 Bacterial Source Tracking for Rattlesnake Creek 5ARSK009.28.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5ARSK009.28	01/22/07	D6700	03010204	6	142	0%	66%	17%	17%
5ARSK009.28	02/28/07	D6750	03010204	22	46	0%	41%	41%	18%
5ARSK009.28	03/12/07	D6765	03010204	1	2	0%	100%	0%	0%
5ARSK009.28	04/04/07	D6809	03010204	24	112	0%	50%	12%	38%
5ARSK009.28	05/01/07	D6827	03010204	22	36	5%	36%	41%	18%
5ARSK009.28	06/11/07	D6874	03010204	24	88	4%	21%	17%	58%
5ARSK009.28	07/24/07	D6943	03010204	2	4	0%	0%	100%	0%
5ARSK009.28	08/22/07	D6964	03010204	12	32	0%	8%	8%	84%
5ARSK009.28	09/26/07	D7011	03010204	5	24	40%	0%	20%	40%
5ARSK009.28	10/16/07	D7025	03010204	24	74	100%	0%	0%	0%
5ARSK009.28	11/27/07	D7067	03010204	5	8	0%	0%	20%	80%
5ARSK009.28	12/17/07	D7100	03010204	23	330	39%	0%	61%	0%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.51 Bacterial Enumeration for Fontaine Creek at Station 5AFON001.46.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5AFON001.46	1/29/2007	D6715	1/30/2007	52		101.7		1/31/2007	MAF
5AFON001.46	2/21/2007	D6743	2/22/2007	42		95.7		2/23/2007	MAF
5AFON001.46	3/7/2007	D6763	3/8/2007	52		110		3/9/2007	MAF
5AFON001.46	4/3/2007	D6803	4/4/2007	38	B	160.1		4/6/2007	MAF
5AFON001.46	5/2/2007	D6834	5/3/2007	84		144.7		5/4/2007	MAF
5AFON001.46	6/12/2007	D6878	6/13/2007	860	B	173.9		6/15/2007	MAF
5AFON001.46	12/17/2007	D7106	12/18/2007	1340	B	127.1		12/20/2007	MAF
5AFON001.46	12/26/2007	D7128	12/27/2007	1230	B	121.8		12/28/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.52 Bacterial Source Tracking for Fontaine Creek at Station 5AFON001.46.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5AFON001.46	01/29/07	D6715	03010204	7	52	0%	14%	29%	57%
5AFON001.46	02/21/07	D6743	03010204	NVI	42	NVI	NVI	NVI	NVI
5AFON001.46	03/07/07	D6763	03010204	24	52	0%	38%	17%	45%
5AFON001.46	04/03/07	D6803	03010204	21	38	0%	14%	19%	67%
5AFON001.46	05/02/07	D6834	03010204	13	84	31%	31%	23%	15%
5AFON001.46	06/12/07	D6878	03010204	24	860	12%	12%	12%	64%
5AFON001.46	12/17/07	D7106	03010204	24	1340	17%	38%	12%	33%
5AFON001.46	12/26/07	D7128	03010204	24	1230	54%	21%	25%	0%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.53 Bacterial Enumeration for Fontaine Creek at Station 5AFON014.38.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5AFON014.38	1/29/2007	D6714	1/30/2007	34	B	79.8		1/31/2007	MAF
5AFON014.38	2/21/2007	D6742	2/22/2007	22	B	78.9		2/23/2007	MAF
5AFON014.38	3/7/2007	D6762	3/8/2007	16	B	86.7		3/9/2007	MAF
5AFON014.38	4/3/2007	D6802	4/4/2007	6	B	116.9		4/6/2007	MAF
5AFON014.38	5/2/2007	D6833	5/3/2007	6	B	111.7		5/4/2007	MAF
5AFON014.38	6/12/2007	D6877	6/13/2007	40		132.9		6/15/2007	MAF
5AFON014.38	7/10/2007	D6917	7/11/2007	18	B	114		7/12/2007	MAF
5AFON014.38	8/15/2007	D6960	8/16/2007	4	B	120		8/17/2007	MAF
5AFON014.38	9/11/2007	D6989	9/12/2007	2	B	123.6		9/14/2007	MAF
5AFON014.38	10/3/2007	D7019	10/4/2007	1	U	134.9		10/5/2007	MAF
5AFON014.38	11/28/2007	D7076	11/29/2007	124		115.7		11/30/2007	MAF
5AFON014.38	12/10/2007	D7084	12/11/2007	98		135.3		12/14/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.54 Bacterial Source Tracking for Fontaine Creek at Station 5AFON014.38.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5AFON014.38	01/29/07	D6714	03010204	7	34	14%	43%	0%	43%
5AFON014.38	02/21/07	D6742	03010204	NVI	22	NVI	NVI	NVI	NVI
5AFON014.38	03/07/07	D6762	03010204	8	16	0%	63%	25%	12%
5AFON014.38	04/03/07	D6802	03010204	3	6	0%	0%	33%	67%
5AFON014.38	05/02/07	D6833	03010204	2	6	50%	0%	50%	0%
5AFON014.38	06/12/07	D6877	03010204	24	40	25%	4%	33%	38%
5AFON014.38	07/10/07	D6917	03010204	9	18	33%	11%	56%	0%
5AFON014.38	08/15/07	D6960	03010204	3	4	34%	33%	33%	0%
5AFON014.38	09/11/07	D6989	03010204	1	2	0%	100%	0%	0%
5AFON014.38	10/03/07	D7019	03010204	NVI	1	NVI	NVI	NVI	NVI
5AFON014.38	11/28/07	D7076	03010204	24	124	8%	46%	42%	4%
5AFON014.38	12/10/07	D7084	03010204	24	98	0%	21%	25%	54%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.55 Bacterial Enumeration for Fontaine Creek at Station 5AFON022.04.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5AFON022.04	1/29/2007	D6713	1/30/2007	26	B	79.3		1/31/2007	MAF
5AFON022.04	2/21/2007	D6741	2/22/2007	76		75.3		2/23/2007	MAF
5AFON022.04	3/7/2007	D6761	3/8/2007	22	B	87		3/9/2007	MAF
5AFON022.04	4/3/2007	D6801	4/4/2007	20	B	106.6		4/6/2007	MAF
5AFON022.04	5/2/2007	D6832	5/3/2007	50		105.3		5/4/2007	MAF
5AFON022.04	6/12/2007	D6876	6/13/2007	14	B	116		6/15/2007	MAF
5AFON022.04	7/10/2007	D6916	7/11/2007	60		78.8		7/12/2007	MAF
5AFON022.04	8/15/2007	D6959	8/16/2007	1	U	84		8/17/2007	MAF
5AFON022.04	9/11/2007	D6988	9/12/2007	8	B	55.5		9/14/2007	MAF
5AFON022.04	10/3/2007	D7018	10/4/2007	22	B	65.1		10/5/2007	MAF
5AFON022.04	11/28/2007	D7075	11/29/2007	4	B	76.1		11/30/2007	MAF
5AFON022.04	12/10/2007	D7083	12/11/2007	90		86.2		12/14/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.56 Bacterial Source Tracking for Fontaine Creek at Station 5AFON022.04.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5AFON022.04	01/29/07	D6713	03010204	NVI	26	NVI	NVI	NVI	NVI
5AFON022.04	02/21/07	D6741	03010204	17	76	0%	12%	6%	82%
5AFON022.04	03/07/07	D6761	03010204	11	22	0%	9%	36%	55%
5AFON022.04	04/03/07	D6801	03010204	12	20	0%	42%	8%	50%
5AFON022.04	05/02/07	D6832	03010204	24	50	4%	51%	33%	12%
5AFON022.04	06/12/07	D6876	03010204	5	14	0%	0%	60%	40%
5AFON022.04	07/10/07	D6916	03010204	24	60	8%	12%	72%	8%
5AFON022.04	08/15/07	D6959	03010204	NVI	1	NVI	NVI	NVI	NVI
5AFON022.04	09/11/07	D6988	03010204	5	8	0%	80%	0%	20%
5AFON022.04	10/03/07	D7018	03010204	8	22	62%	38%	0%	0%
5AFON022.04	11/28/07	D7075	03010204	2	4	50%	0%	50%	0%
5AFON022.04	12/10/07	D7083	03010204	15	90	87%	13%	0%	0%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.57 Bacterial Enumeration for Fontaine Creek at Station 5AFON037.89.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
5AFON037.89	1/29/2007	D6716	1/30/2007	30	B	76.3		1/31/2007	MAF
5AFON037.89	2/14/2007	D6738	2/15/2007	190	B	100.6		2/16/2007	MAF
5AFON037.89	3/5/2007	D6755	3/6/2007	84		83.9		3/7/2007	MAF
5AFON037.89	4/3/2007	D6804	4/4/2007	80		128.6		4/6/2007	MAF
5AFON037.89	5/2/2007	D6835	5/3/2007	34	B	124.5		5/4/2007	MAF
5AFON037.89	6/12/2007	D6875	6/13/2007	146		144.7		6/15/2007	MAF
5AFON037.89	7/10/2007	D6918	7/11/2007	46		125.7		7/12/2007	MAF
5AFON037.89	8/15/2007	D6961	8/16/2007	4	B	130.2		8/17/2007	MAF
5AFON037.89	9/11/2007	D6990	9/12/2007	40		102.2		9/14/2007	MAF
5AFON037.89	11/27/2007	D7068	11/28/2007	1	U	85.5		11/30/2007	MAF
5AFON037.89	12/11/2007	D7089	12/12/2007	82		78.7		12/14/2007	MAF
5AFON037.89	12/17/2007	D7107	12/18/2007	300		80.6		12/20/2007	MAF
5AFON037.89	12/26/2007	D7129	12/27/2007	46		110.7		12/28/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.58 Bacterial Source Tracking for Fontaine Creek at Station 5AFON037.89

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
5AFON037.89	01/29/07	D6716	03010204	8	30	0%	24%	38%	38%
5AFON037.89	02/14/07	D6738	03010204	24	190	25%	12%	17%	46%
5AFON037.89	03/05/07	D6755	03010204	18	84	0%	17%	28%	55%
5AFON037.89	04/03/07	D6804	03010204	21	80	0%	19%	43%	38%
5AFON037.89	05/02/07	D6835	03010204	19	34	16%	32%	26%	26%
5AFON037.89	06/12/07	D6875	03010204	23	146	0%	4%	4%	92%
5AFON037.89	07/10/07	D6918	03010204	24	46	0%	33%	17%	50%
5AFON037.89	08/15/07	D6961	03010204	2	4	100%	0%	0%	0%
5AFON037.89	09/11/07	D6990	03010204	24	40	8%	38%	29%	25%
5AFON037.89	11/27/07	D7068	03010204	NVI	1	NVI	NVI	NVI	NVI
5AFON037.89	12/11/07	D7089	03010204	24	82	8%	46%	46%	0%
5AFON037.89	12/17/07	D7107	03010204	18	300	45%	22%	11%	22%
5AFON037.89	12/26/07	D7129	03010204	14	46	58%	14%	7%	21%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

5.5 Results for Southwest Region

The results of the water quality analyses for VADEQ's Southwest Region (Figure 5.5) are reported in the following tables. Table 5.59 indicates the number of samples analyzed in the 2007-2008 sampling phase. Bacteria enumerations, optical brighteners concentrations and BST analysis results are reported in Table 5.60 through 5.75.

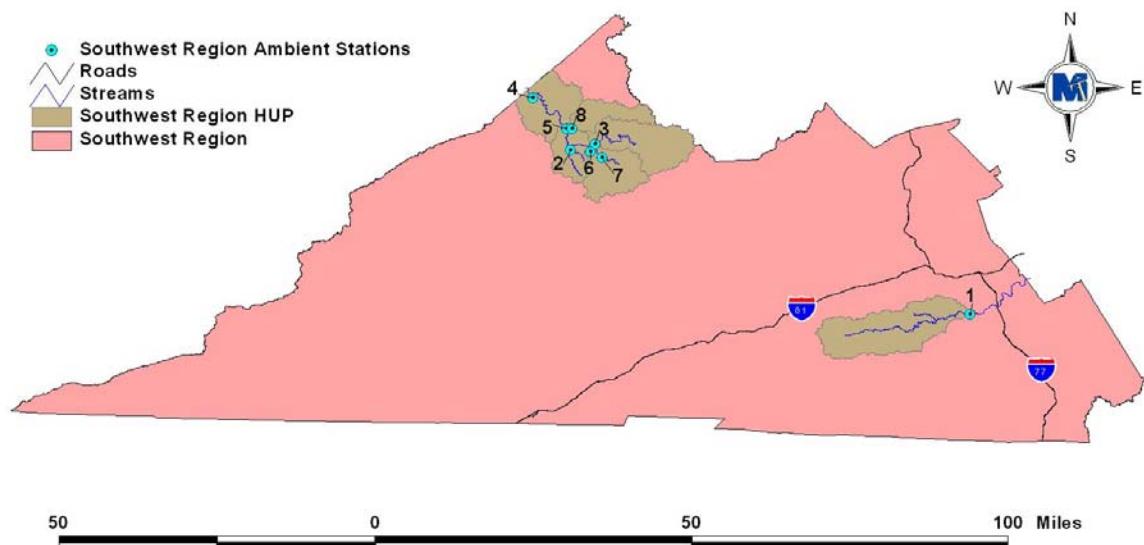


Figure 5.5 Bacterial sampling stations in Southwest Region.

Table 5.59 Summary of bacterial sampling in VADEQ's Southwest Region.

Station Number	Station ID	HUC	Stream Name	# of Samples Received	% Violations for <i>E. Coli</i>
1	9-CPL001.03	05050001	Cripple Creek	11	18%
2	6ABIP000.18	05070202	Big Prater Creek	10	0%
3	6ADIS001.24	05070202	Dismal Creek	10	10%
4	6ALEV131.52	05070202	Levisa	10	10%
5	6ALEV143.80	05070202	Levisa	10	40%
6	6ALEV152.46	05070202	Levisa	10	10%
7	6ALEV156.82	05070202	Levisa	10	60%
8	6ASAT000.26	05070202	Slate Creek	10	40%

Table 5.60 Bacterial Enumeration for Cripple Creek at Station 9-CPL001.03.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
9CPL001.03	3/28/2007	D6792	3/29/2007	76		23.6		4/2/2007	MAF
9CPL001.03	4/24/2007	D6824	4/25/2007	104		23.8		4/27/2007	MAF
9CPL001.03	5/23/2007	D6852	5/24/2007	150		25.5		5/29/2007	MAF
9CPL001.03	6/18/2007	D6899	6/19/2007	110		27.5		6/21/2007	MAF
9CPL001.03	7/24/2007	D6939	7/25/2007	310		32		7/27/2007	MAF
9CPL001.03	8/20/2007	D6962	8/21/2007	1000	B	32.1		8/22/2007	MAF
9CPL001.03	9/24/2007	D7005	9/25/2007	108		29.9		9/26/2007	MAF
9CPL001.03	10/23/2007	D7033	10/24/2007	88		34.2		10/26/2007	MAF
9CPL001.03	11/27/2007	D7063	11/28/2007	26	B	23.4		11/30/2007	MAF
9CPL001.03	12/18/2007	D7115	12/19/2007	102		29.1		12/21/2007	MAF
9CPL001.03	1/28/2008	D7154	1/29/2008	48		22.3		2/4/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.61 Bacterial Source Tracking for Cripple Creek at Station 9-CPL001.03.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
9CPL001.03	3/28/07	D6792	05050001	19	76	11%	16%	26%	47%
9CPL001.03	4/24/07	D6824	05050001	21	104	24%	10%	5%	61%
9CPL001.03	5/23/07	D6852	05050001	17	150	0%	0%	6%	94%
9CPL001.03	6/18/07	D6899	05050001	19	110	32%	21%	47%	0%
9CPL001.03	7/24/07	D6939	05050001	22	310	18%	41%	36%	5%
9CPL001.03	8/20/07	D6962	05050001	5	1,000	20%	40%	0%	40%
9CPL001.03	9/24/07	D7005	05050001	13	108	15%	8%	54%	23%
9CPL001.03	10/23/07	D7033	05050001	19	88	16%	21%	58%	5%
9CPL001.03	11/27/07	D7063	05050001	16	26	31%	0%	63%	6%
9CPL001.03	12/18/07	D7115	05050001	9	102	11%	22%	56%	11%
9CPL001.03	1/28/08	D7154	05050001	24	48	8%	8%	38%	46%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.62 Bacterial Enumeration for Big Prater Creek at Station 6ABIP000.18.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
6ABIP000.18	3/28/2007	D6788	3/29/2007	82		32.1		4/2/2007	MAF
6ABIP000.18	4/23/2007	D6820	4/24/2007	24	B	27.8		4/27/2007	MAF
6ABIP000.18	5/23/2007	D6848	5/24/2007	80		37		5/29/2007	MAF
6ABIP000.18	6/18/2007	D6895	6/19/2007	60		33.2		6/21/2007	MAF
6ABIP000.18	7/24/2007	D6935	7/25/2007	99	B	54.1		7/27/2007	MAF
6ABIP000.18	8/28/2007	D6972	8/29/2007	50		38.7		8/31/2007	MAF
6ABIP000.18	9/24/2007	D7001	9/25/2007	74		41.2		9/26/2007	MAF
6ABIP000.18	10/23/2007	D7029	10/24/2007	120		36.7		10/26/2007	MAF
6ABIP000.18	11/27/2007	D7059	11/28/2007	110		41.7		11/30/2007	MAF
6ABIP000.18	12/18/2007	D7112	12/19/2007	60		38.5		12/21/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.63 Bacterial Source Tracking for Big Prater Creek at Station 6ABIP000.18.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
6ABIP000.18	03/28/07	D6788	05070202	24	82	12%	71%	17%	0%
6ABIP000.18	04/23/07	D6820	05070202	13	24	0%	69%	31%	0%
6ABIP000.18	05/23/07	D6848	05070202	15	80	7%	73%	20%	0%
6ABIP000.18	06/18/07	D6895	05070202	10	60	0%	70%	30%	0%
6ABIP000.18	07/24/07	D6935	05070202	24	99	96%	0%	0%	4%
6ABIP000.18	08/28/07	D6972	05070202	24	50	50%	17%	29%	4%
6ABIP000.18	09/24/07	D7001	05070202	23	74	9%	69%	22%	0%
6ABIP000.18	10/23/07	D7029	05070202	24	120	47%	8%	12%	33%
6ABIP000.18	11/27/07	D7059	05070202	24	110	29%	29%	8%	34%
6ABIP000.18	12/18/07	D7112	05070202	23	60	17%	79%	4%	0%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.64 Bacterial Enumeration for Dismal Creek at Station 6ADIS001.24.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
6ADIS001.24	3/28/2007	D6786	3/29/2007	16	B	27.7		4/2/2007	MAF
6ADIS001.24	4/23/2007	D6818	4/24/2007	22	B	26.6		4/27/2007	MAF
6ADIS001.24	5/23/2007	D6846	5/24/2007	30	B	28.7		5/29/2007	MAF
6ADIS001.24	6/18/2007	D6893	6/19/2007	70		35.3		6/21/2007	MAF
6ADIS001.24	7/24/2007	D6933	7/25/2007	370		45.2		7/27/2007	MAF
6ADIS001.24	8/28/2007	D6970	8/29/2007	42		35.7		8/31/2007	MAF
6ADIS001.24	9/24/2007	D6999	9/25/2007	42		37.6		9/26/2007	MAF
6ADIS001.24	10/23/2007	D7027	10/24/2007	18	B	37.8		10/26/2007	MAF
6ADIS001.24	11/27/2007	D7057	11/28/2007	10	B	33.9		11/30/2007	MAF
6ADIS001.24	12/18/2007	D7109	12/19/2007	4	B	33.3		12/21/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.65 Bacterial Source Tracking for Dismal Creek at Station 6ADIS001.24.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
6ADIS001.24	03/28/07	D6786	05070202	10	16	0%	90%	10%	0%
6ADIS001.24	04/23/07	D6818	05070202	16	22	12%	51%	31%	6%
6ADIS001.24	05/23/07	D6846	05070202	18	30	17%	38%	28%	17%
6ADIS001.24	06/18/07	D6893	05070202	13	70	23%	23%	23%	31%
6ADIS001.24	07/24/07	D6933	05070202	23	370	35%	52%	13%	0%
6ADIS001.24	08/28/07	D6970	05070202	21	42	29%	38%	0%	33%
6ADIS001.24	09/24/07	D6999	05070202	23	42	39%	44%	0%	17%
6ADIS001.24	10/23/07	D7027	05070202	9	18	22%	67%	0%	11%
6ADIS001.24	11/27/07	D7057	05070202	5	10	80%	0%	0%	20%
6ADIS001.24	12/18/07	D7109	05070202	2	4	0%	50%	50%	0%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.66 Bacterial Enumeration for Levisa at Station 6ALEV131.52.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
6ALEV131.52	3/28/2007	D6791	3/29/2007	12	B	28		4/2/2007	MAF
6ALEV131.52	4/23/2007	D6823	4/24/2007	28	B	38		4/27/2007	MAF
6ALEV131.52	5/23/2007	D6851	5/24/2007	46		29.7		5/29/2007	MAF
6ALEV131.52	6/18/2007	D6898	6/19/2007	10	B	29		6/21/2007	MAF
6ALEV131.52	7/24/2007	D6938	7/25/2007	>2001	L	65.3		7/27/2007	MAF
6ALEV131.52	8/28/2007	D6975	8/29/2007	26	B	39.2		8/31/2007	MAF
6ALEV131.52	9/24/2007	D7004	9/25/2007	12	B	38.2		9/26/2007	MAF
6ALEV131.52	10/23/2007	D7032	10/24/2007	18	B	68.8		10/26/2007	MAF
6ALEV131.52	11/27/2007	D7062	11/28/2007	18	B	36.7		11/30/2007	MAF
6ALEV131.52	12/18/2007	D7111	12/19/2007	72		35.1		12/21/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range.

L: Off-scale high. Actual value not known, but known to be greater than value shown.

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.67 Bacterial Source Tracking for Levisa at Station 6ALEV131.52.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
6ALEV131.52	03/28/07	D6791	05070202	8	12	0%	50%	25%	25%
6ALEV131.52	04/23/07	D6823	05070202	12	28	0%	83%	0%	17%
6ALEV131.52	05/23/07	D6851	05070202	21	46	5%	43%	38%	14%
6ALEV131.52	06/18/07	D6898	05070202	3	10	33%	0%	67%	0%
6ALEV131.52	07/24/07	D6938	05070202	24	>2,001	46%	8%	25%	21%
6ALEV131.52	08/28/07	D6975	05070202	12	26	0%	75%	8%	17%
6ALEV131.52	09/24/07	D7004	05070202	4	12	0%	75%	0%	25%
6ALEV131.52	10/23/07	D7032	05070202	7	18	29%	29%	13%	29%
6ALEV131.52	11/27/07	D7062	05070202	12	18	8%	17%	67%	8%
6ALEV131.52	12/18/07	D7111	05070202	24	72	0%	46%	46%	8%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.68 Bacterial Enumeration for Levisa at Station 6ALEV143.80.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
6ALEV143.80	3/28/2007	D6790	3/29/2007	4	B	27.2		4/2/2007	MAF
6ALEV143.80	4/23/2007	D6822	4/24/2007	30	B	26.3		4/27/2007	MAF
6ALEV143.80	5/23/2007	D6850	5/24/2007	260		30.4		5/29/2007	MAF
6ALEV143.80	6/18/2007	D6897	6/19/2007	230		30.2		6/21/2007	MAF
6ALEV143.80	7/24/2007	D6937	7/25/2007	>2001	L	49.6		7/27/2007	MAF
6ALEV143.80	8/28/2007	D6974	8/29/2007	58		46		8/31/2007	MAF
6ALEV143.80	9/24/2007	D7003	9/25/2007	240		37.8		9/26/2007	MAF
6ALEV143.80	10/23/2007	D7031	10/24/2007	1390	B	59.4		10/26/2007	MAF
6ALEV143.80	11/27/2007	D7061	11/28/2007	82		38.9		11/30/2007	MAF
6ALEV143.80	12/18/2007	D7114	12/19/2007	22	B	36.5		12/21/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range.

L: Off-scale high. Actual value not known, but known to be greater than value shown.

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.69 Bacterial Source Tracking for Levisa at Station 6ALEV143.80.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
6ALEV143.80	03/28/07	D6790	05070202	3	4	0%	67%	0%	33%
6ALEV143.80	04/23/07	D6822	05070202	13	30	0%	84%	8%	8%
6ALEV143.80	05/23/07	D6850	05070202	20	260	10%	60%	25%	5%
6ALEV143.80	06/18/07	D6897	05070202	15	230	20%	7%	40%	33%
6ALEV143.80	07/24/07	D6937	05070202	24	>2,001	54%	4%	17%	25%
6ALEV143.80	08/28/07	D6974	05070202	10	58	0%	100%	0%	0%
6ALEV143.80	09/24/07	D7003	05070202	12	240	0%	33%	67%	0%
6ALEV143.80	10/23/07	D7031	05070202	17	1,390	6%	64%	12%	18%
6ALEV143.80	11/27/07	D7061	05070202	24	82	21%	0%	41%	38%
6ALEV143.80	12/18/07	D7114	05070202	11	22	9%	64%	18%	9%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.70 Bacterial Enumeration for Levisa at Station 6ALEV152.46.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
6ALEV152.46	3/28/2007	D6787	3/29/2007	24	B	30.7		4/2/2007	MAF
6ALEV152.46	4/23/2007	D6819	4/24/2007	22	B	29		4/27/2007	MAF
6ALEV152.46	5/23/2007	D6847	5/24/2007	152		35.2		5/29/2007	MAF
6ALEV152.46	6/18/2007	D6894	6/19/2007	70		33.1		6/21/2007	MAF
6ALEV152.46	7/24/2007	D6934	7/25/2007	510		67.6		7/27/2007	MAF
6ALEV152.46	8/28/2007	D6971	8/29/2007	28	B	39.1		8/31/2007	MAF
6ALEV152.46	9/24/2007	D7000	9/25/2007	10	B	47.4		9/26/2007	MAF
6ALEV152.46	10/23/2007	D7028	10/24/2007	20	B	104.5		10/26/2007	MAF
6ALEV152.46	11/27/2007	D7058	11/28/2007	4	B	108.7		11/30/2007	MAF
6ALEV152.46	12/18/2007	D7110	12/19/2007	22	B	50.4		12/21/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.71 Bacterial Source Tracking for Levisa at Station 6ALEV152.46.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
6ALEV152.46	03/28/07	D6787	05070202	16	24	25%	56%	19%	0%
6ALEV152.46	04/23/07	D6819	05070202	13	22	0%	70%	15%	15%
6ALEV152.46	05/23/07	D6847	05070202	24	152	21%	42%	29%	8%
6ALEV152.46	06/18/07	D6894	05070202	6	70	0%	17%	66%	17%
6ALEV152.46	07/24/07	D6934	05070202	24	510	88%	0%	8%	4%
6ALEV152.46	08/28/07	D6971	05070202	19	28	64%	5%	5%	26%
6ALEV152.46	09/24/07	D7000	05070202	7	10	0%	71%	0%	29%
6ALEV152.46	10/23/07	D7028	05070202	3	20	33%	67%	0%	0%
6ALEV152.46	11/27/07	D7058	05070202	2	4	100%	0%	0%	0%
6ALEV152.46	12/18/07	D7110	05070202	8	22	0%	88%	0%	12%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.72 Bacterial Enumeration for Levisa at Station 6ALEV156.82.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
6ALEV156.82	3/28/2007	D6785	3/29/2007	14	B	32.6		4/2/2007	MAF
6ALEV156.82	4/23/2007	D6817	4/24/2007	46		27.9		4/27/2007	MAF
6ALEV156.82	5/23/2007	D6845	5/24/2007	260		34.8		5/29/2007	MAF
6ALEV156.82	6/18/2007	D6892	6/19/2007	260		33.6		6/21/2007	MAF
6ALEV156.82	7/24/2007	D6932	7/25/2007	>2001	L	69.1		7/27/2007	MAF
6ALEV156.82	8/28/2007	D6969	8/29/2007	770		37.9		8/31/2007	MAF
6ALEV156.82	9/24/2007	D6998	9/25/2007	260		40.7		9/26/2007	MAF
6ALEV156.82	10/23/2007	D7026	10/24/2007	380		40.2		10/26/2007	MAF
6ALEV156.82	11/27/2007	D7056	11/28/2007	235	A	83.1		11/30/2007	MAF
6ALEV156.82	12/18/2007	D7108	12/19/2007	58		42.1		12/21/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range.

L: Off-scale high. Actual value not known, but known to be greater than value shown.

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.73 Bacterial Source Tracking for Levisa at Station 6ALEV156.82.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
6ALEV156.82	03/28/07	D6785	05070202	9	14	0%	56%	44%	0%
6ALEV156.82	04/23/07	D6817	05070202	24	46	8%	67%	25%	0%
6ALEV156.82	05/23/07	D6845	05070202	22	260	9%	77%	5%	9%
6ALEV156.82	06/18/07	D6892	05070202	13	260	31%	8%	38%	23%
6ALEV156.82	07/24/07	D6932	05070202	24	>2,001	46%	50%	0%	4%
6ALEV156.82	08/28/07	D6969	05070202	24	770	67%	33%	0%	0%
6ALEV156.82	09/24/07	D6998	05070202	16	260	0%	94%	6%	0%
6ALEV156.82	10/23/07	D7026	05070202	23	380	26%	48%	0%	26%
6ALEV156.82	11/27/07	D7056	05070202	24	235	8%	84%	0%	8%
6ALEV156.82	12/18/07	D7108	05070202	23	58	0%	74%	13%	13%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.74 Bacterial Enumeration for Slate Creek at Station 6ASAT000.26.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
6ASAT000.26	3/28/2007	D6789	3/29/2007	104		30		4/2/2007	MAF
6ASAT000.26	4/23/2007	D6821	4/24/2007	52		34.8		4/27/2007	MAF
6ASAT000.26	5/23/2007	D6849	5/24/2007	221	A	39.6		5/29/2007	MAF
6ASAT000.26	6/18/2007	D6896	6/19/2007	36	B	35.1		6/21/2007	MAF
6ASAT000.26	7/24/2007	D6936	7/25/2007	>2001	L	60.5		7/27/2007	MAF
6ASAT000.26	8/28/2007	D6973	8/29/2007	460		40.6		8/31/2007	MAF
6ASAT000.26	9/24/2007	D7002	9/25/2007	620		42.6		9/26/2007	MAF
6ASAT000.26	10/23/2007	D7030	10/24/2007	730		41.3		10/26/2007	MAF
6ASAT000.26	11/27/2007	D7060	11/28/2007	84		42.7		11/30/2007	MAF
6ASAT000.26	12/18/2007	D7113	12/19/2007	62		35.5		12/21/2007	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range.

L: Off-scale high. Actual value not known, but known to be greater than value shown.

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.75 Bacterial Source Tracking for Slate Creek at Station 6ASAT000.26.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
6ASAT000.26	03/28/07	D6789	05070202	24	104	21%	58%	17%	4%
6ASAT000.26	04/23/07	D6821	05070202	21	52	24%	66%	0%	10%
6ASAT000.26	05/23/07	D6849	05070202	19	221	11%	73%	11%	5%
6ASAT000.26	06/18/07	D6896	05070202	16	36	25%	19%	37%	19%
6ASAT000.26	07/24/07	D6936	05070202	22	>2,001	27%	27%	32%	14%
6ASAT000.26	08/28/07	D6973	05070202	10	460	0%	80%	20%	0%
6ASAT000.26	09/24/07	D7002	05070202	4	620	25%	50%	25%	0%
6ASAT000.26	10/23/07	D7030	05070202	19	730	16%	26%	16%	42%
6ASAT000.26	11/27/07	D7060	05070202	24	84	25%	29%	4%	42%
6ASAT000.26	12/18/07	D7113	05070202	24	62	21%	29%	46%	4%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

5.6 Results for West Central Region

The results of the water quality analyses for VADEQ's West Central Region (Figure 5.6) are reported in the following tables. Table 5.76 indicates the number of samples analyzed in the 2007-2008 sampling phase. Bacteria enumerations, optical brighteners concentrations and BST analysis results are reported in Table 5.77 through 5.86.

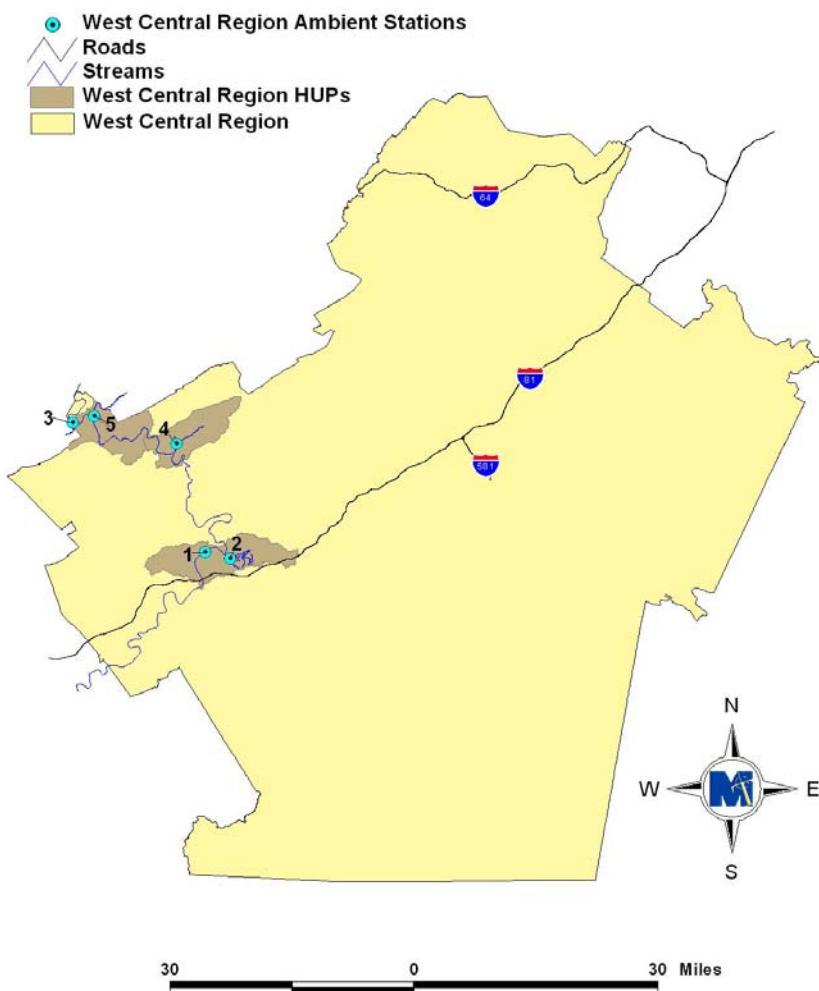


Figure 5.6 Bacterial sampling stations in West Central Region.

Table 5.76 Summary of bacterial sampling in VADEQ's West Central Region.

Station Number	Station ID	HUC	Stream Name	# of Samples Received	% Violations for <i>E. Coli</i>
1	9-CNL000.01	05050001	Connellys Run	12	33%
2	9-PLM000.60	05050001	Plum Creek	12	33%
3	9-ADR000.13	05050002	Adair Run	12	8%
4	9-LRY000.28	05050002	Little Stony Creek	6	0%
5	9-RHC000.08	05050002	Rich Creek	12	58%

Table 5.77 Bacterial Enumeration for Connellys Run at Station 9-CNL000.01.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
9CNL000.01	7/24/2007	D6929	7/25/2007	790		127.9		7/27/2007	MAF
9CNL000.01	8/6/2007	D6945	8/7/2007	188	B	36.3		8/8/2007	MAF
9CNL000.01	9/11/2007	D6985	9/12/2007	940	B	150.4		9/14/2007	MAF
9CNL000.01	10/16/2007	D7021	10/16/2007	40		30.2		10/22/2007	MAF
9CNL000.01	11/14/2007	D7048	11/15/2007	32	B	32.9		11/19/2007	MAF
9CNL000.01	12/18/2007	D7095	12/18/2007	80		43.5		12/24/2007	MAF
9CNL000.01	1/15/2008	D7145	1/16/2008	126		34.5		1/18/2008	MAF
9CNL000.01	2/6/2008	D7163	2/6/2008	80		46.5		2/11/2008	MAF
9CNL000.01	3/25/2008	D7228	3/25/2008	2	B	34.2		3/31/2008	MAF
9CNL000.01	4/15/2008	D7252	4/15/2008	16	B	33.7		4/22/2008	MAF
9CNL000.01	5/20/2008	D7290	5/20/2008	1,260	B	65		5/27/2008	MAF
9CNL000.01	6/24/2008	D7328	6/24/2008	260		40.8		6/26/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.78 Bacterial Source Tracking for Connellys Run at Station 9-CNL000.01.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
9CNL000.01	7/24/07	D6929	05050001	24	790	75%	4%	21%	0%
9CNL000.01	8/6/07	D6945	05050001	24	188	33%	0%	4%	63%
9CNL000.01	9/11/07	D6985	05050001	24	940	75%	0%	21%	4%
9CNL000.01	10/16/07	D7021	05050001	12	40	17%	33%	25%	25%
9CNL000.01	11/14/07	D7048	05050001	20	32	5%	5%	30%	60%
9CNL000.01	12/18/07	D7095	05050001	23	80	43%	9%	0%	48%
9CNL000.01	1/15/08	D7145	05050001	24	126	63%	8%	29%	0%
9CNL000.01	2/6/08	D7163	05050001	17	80	6%	12%	70%	12%
9CNL000.01	3/25/08	D7228	05050001	NVI	2	NVI	NVI	NVI	NVI
9CNL000.01	4/15/08	D7252	05050001	9	16	89%	0%	0%	11%
9CNL000.01	5/20/08	D7290	05050001	24	1,260	71%	0%	4%	25%
9CNL000.01	6/24/08	D7328	05050001	24	260	54%	17%	0%	29%

BOLD type indicates a statistically significant value.

*NVI - No Viable isolates

Table 5.79 Bacterial Enumeration for Plum Creek at Station 9-PLM000.60.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
9PLM000.60	7/24/2007	D6928	7/25/2007	1020	B	68.9		7/27/2007	MAF
9PLM000.60	8/6/2007	D6944	8/7/2007	250		37.7		8/8/2007	MAF
9PLM000.60	9/11/2007	D6984	9/12/2007	840	B	81.9		9/14/2007	MAF
9PLM000.60	10/16/2007	D7020	10/16/2007	108		38.4		10/22/2007	MAF
9PLM000.60	11/14/2007	D7047	11/15/2007	42		37.7		11/19/2007	MAF
9PLM000.60	12/18/2007	D7094	12/18/2007	118		42.1		12/24/2007	MAF
9PLM000.60	1/15/2008	D7144	1/16/2008	16	B	33		1/18/2008	MAF
9PLM000.60	2/6/2008	D7162	2/6/2008	72		42		2/11/2008	MAF
9PLM000.60	3/25/2008	D7227	3/25/2008	44		34.3		3/31/2008	MAF
9PLM000.60	4/15/2008	D7251	4/15/2008	96		35.3		4/22/2008	MAF
9PLM000.60	5/20/2008	D7289	5/20/2008	144		43.1		5/27/2008	MAF
9PLM000.60	6/24/2008	D7327	6/24/2008	240		40.1		6/26/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.80 Bacterial Source Tracking for Plum Creek at Station 9-PLM000.60.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
9PLM000.60	7/24/07	D6928	05050001	24	1,020	79%	4%	17%	0%
9PLM000.60	8/6/07	D6944	05050001	20	250	45%	15%	0%	40%
9PLM000.60	9/11/07	D6984	05050001	12	840	17%	33%	42%	8%
9PLM000.60	10/16/07	D7020	05050001	9	108	45%	11%	33%	11%
9PLM000.60	11/14/07	D7047	05050001	23	42	57%	13%	4%	26%
9PLM000.60	12/18/07	D7094	05050001	24	118	54%	0%	0%	46%
9PLM000.60	1/15/08	D7144	05050001	8	16	12%	12%	12%	64%
9PLM000.60	2/6/08	D7162	05050001	24	72	63%	0%	4%	33%
9PLM000.60	3/25/08	D7227	05050001	20	44	65%	0%	25%	10%
9PLM000.60	4/15/08	D7251	05050001	21	96	47%	5%	43%	5%
9PLM000.60	5/20/08	D7289	05050001	24	144	75%	0%	0%	25%
9PLM000.60	6/24/08	D7327	05050001	24	240	4%	29%	25%	42%

BOLD type indicates a statistically

*NVI - No Viable isolates

Table 5.81 Bacterial Enumeration for Adair Run at Station 9-ADR000.13.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
9ADR000.13	7/24/2007	D6931	7/25/2007	1050	B	66.4		7/27/2007	MAF
9ADR000.13	8/6/2007	D6947	8/7/2007	68		48.2		8/8/2007	MAF
9ADR000.13	9/11/2007	D6987	9/12/2007	22	B	56.3		9/14/2007	MAF
9ADR000.13	10/16/2007	D7023	10/16/2007	32	B	41.1		10/22/2007	MAF
9ADR000.13	11/14/2007	D7050	11/15/2007	26	B	39.2		11/19/2007	MAF
9ADR000.13	12/18/2007	D7098	12/18/2007	80		44.3		12/24/2007	MAF
9ADR000.13	1/15/2008	D7148	1/16/2008	102		40.6		1/18/2008	MAF
9ADR000.13	2/6/2008	D7166	2/6/2008	120		37.8		2/11/2008	MAF
9ADR000.13	3/25/2008	D7231	3/25/2008	14	B	31.9		3/31/2008	MAF
9ADR000.13	4/15/2008	D7255	4/15/2008	20	B	33.3		4/22/2008	MAF
9ADR000.13	5/20/2008	D7293	5/20/2008	156		39.4		5/27/2008	MAF
9ADR000.13	6/24/2008	D7330	6/24/2008	106		48.2		6/26/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.82 Bacterial Source Tracking for Adair Run at Station 9-ADR000.13.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
9ADR000.13	07/24/07	D6931	05050002	19	1,050	11%	21%	57%	11%
9ADR000.13	08/06/07	D6947	05050002	24	68	71%	21%	8%	0%
9ADR000.13	09/11/07	D6987	05050002	12	22	8%	25%	50%	17%
9ADR000.13	10/16/07	D7023	05050002	21	32	14%	0%	86%	0%
9ADR000.13	11/14/07	D7050	05050002	14	26	7%	93%	0%	0%
9ADR000.13	12/18/07	D7098	05050002	6	80	34%	33%	0%	33%
9ADR000.13	01/15/08	D7148	05050002	24	102	67%	12%	21%	0%
9ADR000.13	02/06/08	D7166	05050002	16	120	19%	19%	0%	62%
9ADR000.13	03/25/08	D7231	05050002	6	14	0%	33%	50%	17%
9ADR000.13	04/15/08	D7255	05050002	7	20	57%	14%	29%	0%
9ADR000.13	05/20/08	D7293	05050002	24	156	4%	25%	17%	54%
9ADR000.13	06/24/08	D7330	05050002	24	106	17%	45%	0%	38%

BOLD type indicates a statistically

*NVI - No Viable isolates

Table 5.83 Bacterial Enumeration for Little Stony Creek 9-LRY000.28.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
9LRY000.28	12/18/2007	D7096	12/18/2007	20	B	26.4		12/24/2007	MAF
9LRY000.28	1/15/2008	D7146	1/16/2008	6	B	22.9		1/18/2008	MAF
9LRY000.28	2/6/2008	D7164	2/6/2008	14	B	25.6		2/11/2008	MAF
9LRY000.28	3/25/2008	D7229	3/25/2008	30	B	21		3/31/2008	MAF
9LRY000.28	4/15/2008	D7253	4/15/2008	1	U	22.2		4/22/2008	MAF
9LRY000.28	5/20/2008	D7291	5/20/2008	20	B	26		5/27/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.84 Bacterial Source Tracking for Little Stony Creek 9-LRY000.28.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
9LRY000.28	12/18/2007	D7096	05050002	6	20	66%	17%	17%	0%
9LRY000.28	1/15/2008	D7146	05050002	5	6	60%	20%	20%	0%
9LRY000.28	2/6/2008	D7164	05050002	1	14	100%	0%	0%	0%
9LRY000.28	3/25/2008	D7229	05050002	5	30	NVI	NVI	NVI	NVI
9LRY000.28	4/15/2008	D7253	05050002	0	1	NVI	NVI	NVI	NVI
9LRY000.28	5/20/2008	D7291	05050002	10	20	0%	0%	10%	90%

BOLD type indicates a statistically

*NVI - No Viable isolates

Table 5.85 Bacterial Enumeration for Rich Creek at Station 9-RHC000.08.

Station ID	Date of Sample	Lab ID	Lab-In Date	E. coli cfu/100 ml	Quality	Optical Brighteners /PPB	Comments	Lab-Out Date	Lab Personnel
9RHC000.08	7/24/2007	D6930	7/25/2007	930	B	82.1		7/27/2007	MAF
9RHC000.08	8/6/2007	D6946	8/7/2007	680		66.7		8/8/2007	MAF
9RHC000.08	9/11/2007	D6986	9/12/2007	168	A	81.1		9/14/2007	MAF
9RHC000.08	10/16/2007	D7022	10/16/2007	540		64.4		10/22/2007	MAF
9RHC000.08	11/14/2007	D7049	11/15/2007	72		54.1		11/19/2007	MAF
9RHC000.08	12/18/2007	D7097	12/18/2007	780		73.1		12/24/2007	MAF
9RHC000.08	1/15/2008	D7147	1/16/2008	92		57.8		1/18/2008	MAF
9RHC000.08	2/6/2008	D7165	2/6/2008	52		53.2		2/11/2008	MAF
9RHC000.08	3/25/2008	D7230	3/25/2008	410		44.7		3/31/2008	MAF
9RHC000.08	4/15/2008	D7254	4/15/2008	66		45.3		4/22/2008	MAF
9RHC000.08	5/20/2008	D7292	5/20/2008	310		50.4		5/27/2008	MAF
9RHC000.08	6/24/2008	D7329	6/24/2008	1010	B	59.7		6/26/2008	MAF

A: Value reported is the mean of two or more determinations.

B: Results based upon colony counts outside the acceptable range

U: Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use.

Table 5.86 Bacterial Source Tracking for Rich Creek at Station 9-RHC000.08.

VADEQ ID	Date of Sample	Lab ID	HUC ID	Number of Isolates	E. coli (cfu/100 ml)	Wildlife	Human	Livestock	Pet
9RHC000.08	07/24/07	D6930	05050002	24	930	12%	25%	51%	12%
9RHC000.08	08/06/07	D6946	05050002	13	680	62%	15%	0%	23%
9RHC000.08	09/11/07	D6986	05050002	16	168	31%	50%	0%	19%
9RHC000.08	10/16/07	D7022	05050002	11	540	27%	9%	46%	18%
9RHC000.08	11/14/07	D7049	05050002	22	72	14%	77%	9%	0%
9RHC000.08	12/18/07	D7097	05050002	14	780	29%	43%	21%	7%
9RHC000.08	01/15/08	D7147	05050002	24	92	33%	42%	17%	8%
9RHC000.08	02/06/08	D7165	05050002	14	52	36%	36%	14%	14%
9RHC000.08	03/25/08	D7230	05050002	14	410	7%	57%	0%	36%
9RHC000.08	04/15/08	D7254	05050002	20	66	30%	20%	35%	15%
9RHC000.08	05/20/08	D7292	05050002	24	310	4%	12%	42%	42%
9RHC000.08	06/24/08	D7329	05050002	24	1,010	25%	63%	4%	8%

BOLD type indicates a statistically

*NVI - No Viable isolates

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6. DISCUSSION

Results of the 2007-2008 VADEQ BST program have been presented in this report. The ARCCs achieved during the library development stage are acceptable, and there does not appear to be a high level of over-fitting. Based on the sample size targeted in each sample (*i.e.*, 24 isolates), there is 90% confidence that the proportions measured in each sample are within 15% of the actual proportions in the sampled population (*i.e.*, all bacteria in the stream at the time of sampling). Because a fixed-frequency sampling scheme was used, samples are not biased toward a particular flow regime, and therefore can be combined to estimate the actual proportions contributed by the different sources over the entire year with greater precision (*i.e.*, 90% confidence that the estimate is within 5% of the actual proportions). Additionally, the statistical analyses applied to determine a significant difference from zero give a good indication of presence and absence of each source in each sample. All of these data are valuable for use in improving public awareness of the problem, improving model calibration/validation, and providing a more equitable allocation of loads to source classes.

Since the presence of optical brighteners does not always coincide with the presence of human fecal bacteria, these two indicators should be interpreted together. The consistent presence of optical brighteners with little or no indication of human fecal bacteria indicates likely gray-water discharge(s). The consistent presence of human fecal bacteria without the presence of high optical brightener concentrations may indicate failing septic systems (since optical brighteners photo degrade)-or straight pipes in an area where washing machines are not typically owned or operated during the typical sample times. The presence of both indicators typically signifies a leaking/overflowing sewer system or a high density of failing on-site systems, where the failure is directly discharged to the stream without the need of a washoff event.

In spite of the high quality of the data collected, care should be taken in using these data. These data represent, at most, 12 instantaneous observations at each station and may not be representative of long-term conditions. The hydrologic conditions during this period may not reflect either average or critical conditions. Additionally, the dynamics of the bacterial community are not well understood, so care should be taken in extrapolating from the in-stream condition to activities in the watershed. As with any other monitoring program, the data should

***Bacterial Source Tracking Analyses
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not be viewed in a vacuum. Local knowledge of the sources involved, historical water quality records, and the hydrologic conditions during sampling should all be considered in any interpretation of this data.

REFERENCES

- Hagedorn, C., S. L. Robinson, J. R. Filtz, S. M. Grubbs, T. A. Angier, and R. B. Reneau, Jr. 1999. Using antibiotic resistance patterns in the fecal streptococci to determine sources of fecal pollution in a rural Virginia watershed. *Appl. Environ. Microbiol.* 65:5522-5531.
- USEPA. 1999. Guidance for Water Quality-Based Decisions: The TMDL Process. <http://www.epa.gov/OWOW/tmdl/decisions/dec1c.html>

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*Bacterial Source Tracking Analyses
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APPENDIX A

Bacterial Source Tracking Analyses Supplemental Report

**Bacterial Source Tracking Analyses
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Table A.1 False-positive and correct classification rates for four BST libraries developed in support of VADEQ's Phase-VI BST Program.

Library	False-Positive Rates				Rate of Correct Classification			
	Wildlife	Human	Livestock	Pet	Wildlife	Human	Livestock	Pet
02070005	12.9%	12.1%	7.6%	5.4%	78.9%	70.7%	58.1%	78.2%
02070007	19.4%	7.4%	9.5%	4.5%	75.3%	74.1%	59.3%	68.8%
02070008	6.7%	6.8%	5.0%	21.8%	60.7%	73.8%	69.2%	78.5%
02080109	9.5%	11.1%	4.6%	10.1%	81.2%	65.2%	72.6%	68.4%
02080110	10.8%	6.3%	12.8%	7.0%	69.8%	72.8%	83.2%	62.9%
03010201	15.5%	5.5%	7.1%	7.1%	72.4%	61.4%	85.0%	73.2%
03010204	4.4%	1.8%	8.1%	2.2%	95.2%	82.5%	88.8%	87.5%
05050001	9.5%	10.9%	18.1%	9.9%	52.7%	67.0%	66.6%	68.6%
05070202	23.1%	8.3%	13.0%	7.2%	80.9%	45.2%	64.7%	56.0%
05050002	8.6%	7.9%	8.1%	10.7%	69.3%	77.2%	69.5%	78.0%

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Table A.2 Species sampled for four libraries developed in support of VADEQ's Phase-VI BST Program.

Source Category	Species	02070005	02070007	02070008	02080109	02080110	03010201	03010204	05050001	05070202	05050002
Human	Human	123	81	107	115	82	127	143	578	115	127
Livestock	Beef	124		107	116			111	380	35	128
	Dairy								50		
	Emu									8	
	Mule									8	
	Goat								7	21	
	Guinea Hen					5					
	Horse		81			82	127	32	47	36	
	Poultry								67		
	Rabbit									8	
	Dometric										
	Swine							27	1		
Pet	Cat	6			4				101	14	31
	Dog	118	80	107	115	79	127	120	478	94	96
Wildlife	Bear								13		
	Bobcat										
	Coyote									13	
	Deer	91	81	107	80	31	83	120		69	32
	Duck	7							27	9	16
	Ferret										
	Fox						14		28		
	Fowl										
	Goose	6				29	15		176		79
	Groundhog										
	Muskrat								19		
	Opossum										
	Otter								7		
	Pigeon										
	Quail										
	Rabbit	6								19	
	Raccoon	13			30		7		21		
	Sea Gull				5	17					
	Skunk								7		
	Squirrel								7		
	Wild Turkey						8		35		
	Wildlife-Avian									5	